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Steelfounders' Outlook

The British Steel Founders' Association recently held their third productivity conference. The delegates, besides being a thoroughly representative cross-section of the management of the industry—that is, all grades ranging from the chargehand to the managing director—also mirrored the whole industry, as 70 per cent. of the output is manufactured by the participating firms. The industry uses some 100,000 patterns; does but little mass production; and its output can be regarded as "tailor made." Though lagging behind the Americans, the British steelfoundry industry has the highest production per man-hour of any country in Europe. Each year since 1945, productivity has been increasing, probably (for such things are difficult to assess) by about eight per cent. per annum. There is splendid co-operation amongst the members and every foundry is open for visits from any other maker of steel castings who is a member of the British Steel Founders' Association. A Research Division—shortly to be converted into a Research Association—has been established. This indeed is a record meriting the fullest commendation from industry as a whole.

There are, however, a number of problems still awaiting solution, and these are of such a character as to impede productivity. They were discussed at length at the recent conference. First, the founders want to implement a system whereby they can take young men returning from their period of service with the forces and by systematic training convert them into skilled craftsmen. The attitude of the craft unions is to condemn such men into labouring for the rest of their lives. Yet, on the other hand, every entrant to this industry, if he possesses the necessary business and technical acumen can rise to the top, and indeed many of the higher executives began quite humbly. Next, they deplore a current shortage of technicians. By the means available to them they are giving assistance to their staffs to get additional training and this action is meeting with increasing enthusiasm. Rightly, the steelfounders are taking advantage of existing organizations rather than create their own. A third factor discussed in this context was the lack of ambition inherent in a large section of the British working man. In the South of England and the Midlands the men do show interest in improving their standard of living, but farther north they are content with a "living wage." An effort is being made to stimulate their ambitions to include house and motor-car purchase.

The steelfoundry, in common with all other industries, needs the Government's support in lending their aid to the furtherance of ambition amongst the workmen, for this is the mainspring of the increased productivity which is this country's sole hope of survival in a competitive world. The leaders of this comparatively small industry are doing their best to make the foundry "a good place in which to work" by the provision of washing, bathing, and changing facilities, the suppression of dust, and research into improved grinding methods. Nevertheless, they are insistent that, for the furtherance of their production schemes, a more generous attitude to industrial needs must be taken by Her Majesty's Government.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

IRON AND STEEL BILL

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—It is quite apparent from the letter published in your issue of December 11 that the C.F.A. do not like to hear the voices of those criticizing their actions or expressing opinions on the Iron and Steel Bill, particularly if the views expressed are in opposition to their own.

In the first paragraph of the C.F.A's reply it is stated there is a minority of members and non-members opposed to the Bill. May I ask the C.F.A. if they have taken a recent referendum of both members and non-members as to their reactions to this Bill, for I have good reason to believe that if this was carried out, they would find that those in opposition do not constitute a minority.

Their statement, that there is no contradiction implicit or explicit between the statements made in "To Make Your Voice Heard," and the policy adopted by the C.F.A. in regard to the Bill, rather surprises me, particularly when they include in this booklet such phraseology as "only in this way can liberty of action be retained and further Government intervention be shown to be unnecessary"; "in defence of its principles of individual freedom combined with voluntary action and co-operation," and "resolutely maintains that this work must be allowed to proceed by voluntary action of employers and not by the introduction of rigid Government regulations."

Their quotation by Lord Bruce of Melbourne in no way refers to statutory control of industry. Many other distinguished exponents of private enterprise have stated that it is certainly neither desirable nor necessary to control the foundry industry in perpetuity under a non-democratic permanent statutory order, and further it is a well-known fact that once Boards of this kind are given powers of this type, they inevitably exercise the maximum possible control inherent in their powers.

Here, I wish to refer the C.F.A. to the Grey Ironfounders' Productivity Team Report, in which it is stated, "there are controls in America, but there are many more over here and they cause much irritation and frustration." By this Bill the ironfoundry industry is obviously going to become further irritated and frustrated.

In answer to their question, "Is that happy result not more hopeful of attainment, providing that the ironfounding industry is represented on the Board, as indeed it will be?" In the first place, I fail to understand why it should be necessary to have a statutory Board to ensure that a basic industry receives its rightful share of raw materials, but perhaps if it were merely the control of raw materials that was being sought, I do not think I could seriously object, provided it was a temporary measure only. As far as a guarantee being given to the ironfounders regarding the prices, capital schemes* and even this place on the Board, they are not sufficient to convince me and many others as to the wisdom of including foundries in the Bill.

Personally, I have not the slightest doubt that the C.F.A. has a sense of responsibility to the industry and the country, but then, so has every board of directors controlling the affairs of their own business, and they do not require a statutory board of this type to advise them on how to run them. The C.F.A. state that it is too late now for non-members to claim a right to be heard in the organization, when events are taking a turn that some of them do not like or have failed to consider in good time. May I remind the C.F.A. that non-members do not claim the right to be heard in their organization, but simply the right to be heard as ironfounders. As for failing to consider the proposals in good time, our own objections to this Bill, both in the form of letters and telegrams, commenced at the beginning of October, for it was only at this time that we were in a position to understand what the proposals meant.

If it be too late for non-members to claim the right to be heard, it seems strange that the C.F.A. should go to such lengths to circulate to non-members a copy of the letter which was published in your issue of November 27, explaining the course of events which led up to the formulation of the C.F.A's policy and reasons for adopting it, and which I still contend is in distinct contradiction to the statements made in their booklet, "To Make Your Voice Heard."

Yours, etc.,
G. W. NICHOLLS,
December 16 Modern Foundries Limited.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—May I try to clear up two points which Mr. Whitham makes in his letter in your issue of December 11?

(1) Mr. Whitham says: "If the Bill goes through, it (*i.e.*, the Council of Ironfoundry Associations) has made the iron foundries subject to permanent supervision—that is, supervision for all time." The fact is that the proposals are those of H.M. Government, who consider the casting of iron and steel to be integral parts of the iron and steel industry in its wide sense. The Joint Iron Council (representing the views of its two partners, the Council of Ironfoundry Associations and the Council of Iron Producers) agrees with H.M. Government, subject to various safeguards for which they have asked. These safeguards will be embodied in amendments which H.M. Government proposes to introduce at the committee stage.

(2) Mr. Whitham goes on to say: "The C.F.A. has explained that it did this in order to make sure of adequate raw-material supplies to the foundries. It is admitted now that there is no need to come under the Bill to secure this protection. It is to be the duty of the Iron and Steel Board to keep under review 'the arrangements for procuring and distributing raw materials and fuel for use in the iron and steel industry.' If this is not clear enough, let the Government add on to this clause 'including supplies for iron castings.' It is much better that this should be one of the general duties of the Board rather than that the foundries rely on one ironfounder on a Board of 11 other members." It is a complete mis-statement to say "it is admitted now that there is no need to come under the Bill to secure this protection." On the contrary, everything that has happened in recent months makes it clearer than ever that the long-term interests of the ironfounders in relation to raw materials can only be secured if they are under the protection of the Board. If Mr. Whitham had his way he would delete iron castings from the schedule to the Bill and therefore from the iron and steel industry as defined. Having thus got iron castings out of the industry to be supervised by the Board he then ingenuously suggests that there should be added to the raw-materials clause the words "including supplies for iron castings." This would completely fail to achieve the desired result.

If it were possible to get iron castings out of the

(*Continued on page* 743, *col.* 2)

* The Minister has announced that no new scheme costing less than £250,000 will enter the ambit of the Board's operations.—EDITOR.

Manufacture of Precision Patternplates*

By Bernard Faure

When members of the London branch of the Institute of British Foundrymen visited foundries in the the French Ardennes region, they were particularly impressed by the production methods of the foundry of Faure et Cie, at Revin, especially with regard to mechanized moulding and machine pattern production. The first has already been described in the JOURNAL (**91**, 525, 565) *and the second is dealt with in the account below, which was prepared by the originator of the process.*

The manufacture of patternplates, and especially those used in the stove-grate trade, raises a number of questions to which the Author has directed his attention and which he has tried to answer logically. This research was due to radical changes in methods of moulding at the Author's foundries which necessitated the complete redesign of patternplates in use. The new patternplates for machine moulding had to meet the following conditions:—(1) To be single sided; (2) able to withstand the hard wear associated with combined vibrating and percussion on machines running at production rates of from 250 to 150 moulds per hr.—that is, more than 1,000 operations per day; (3) to be easily mounted and adjusted; (4) suitable for manufacture by the works staff; (5) dimensionally accurate; and (6) economic in cost and in service.

It was the fifth requirement which gave the most trouble. When moulding stove-grate castings, dimensional accuracy is extremely important, because of (*a*) the very thin section of the castings; (*b*) their relatively large size; and (*c*) the high degree of uniformity required owing to the fact that most of the castings are finally vitreous enamelled. The castings made are normally either 3.4 or 3.8 mm. (0.13 to 0.15 in.) thick, and have average surfaces from 30 to 35 sq. decim. (3.2 to 3.8 sq. ft.). They are usually cambered, and therefore carry arch supports of uniform thickness, which thus fix the layout of the casting. Domestic heating appliances are sold as finished entities, and not by weight; prices cannot be altered, and extra weight means an irrecoverable loss. Not only are variations of the thickness of the casting of paramount importance, but there must also be no variation in the location points of a pair of plates.

Types of Plates

Pattern Jigs.—The more complicated elements and fixing units have been incorporated in a jig or plate-carrier to reduce the cost of the patternplates. Figs. 1 and 2 show the jigs in their working position, and the actual plates resting on these supports (in black). They also show the position of moulding boxes round the assembly.

Patternplates.—Fig. 3 shows, for one of the patterns for making the patternplates, the layout of the supporting points both around the perimeter and in the central area. It will be noted that the patternplate is carried on the jig by a series of bosses placed round the perimeter, the object of which will be explained later. In addition, the plate is carried on nine bosses spaced over the whole of its free area, which transmit the pressure and percussion stresses during moulding. It is obvious that these pressures, which are of the order of 10 tons, together with the percussion stresses, cannot be borne by circumferential supports alone, as this would entail patternplates of uneconomical thicknesses. The basic principle of these plates having been determined, the method of developing a system of carrying it out on an industrial scale, rapidly and economically, is next described.

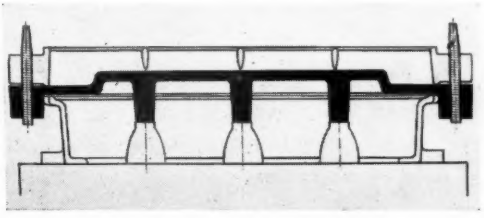


FIG. 1.—*Longitudinal Section through a Large Patternplate (solid black) supported by a Pattern Jig and with a Moulding Box in Position. Note the Spiral-spring Box-pins.*

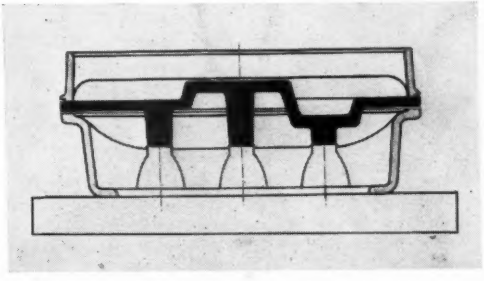


FIG. 2.—*Cross-section through a Smaller Patternplate (solid black) resting on its Pattern Jig and the whole carrying a Half Moulding Box.*

* Translation of a Paper presented to the 25th Congress of the *Association Technique de Fonderie*. The Author is technical director of the Fonderies Faure et Cie, Revin.

FIG. 3.—*Distribution of Supporting Points in a Patternplate Layout.*

FIG. 4.—*Half-mould for Producing the Under-side of a Patternplate. On this is located a Template through which Holes are cut in the Sand to form Bosses and Registering Points.*

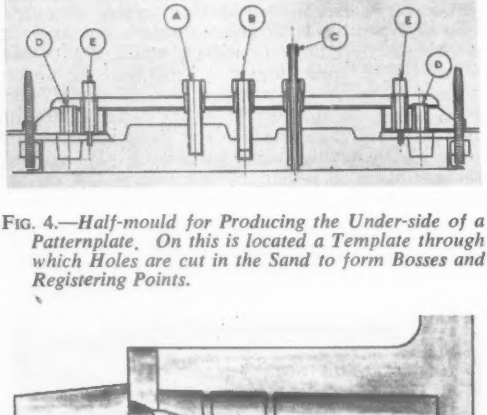


FIG. 5.—*Chill Component Cast into the Bosses of the Patternplate. It is accurately machined on the Faces marked* △.

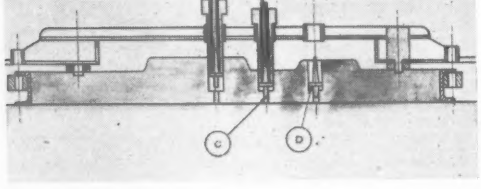


FIG. 6.—*Placing the Chills in position using the same Template as was employed for Producing the Boss Holes.*

Method of Moulding

The casting to be plate-mounted is placed on a very hard-rammed mould part or odd-side. Depending upon circumstances, it is either constructed on one particular plane or elevated by ramming, as if one were making a mould with a more-or-less complicated joint, as is often the case with appliance castings of a very contorted shape. Off this hard-rammed odd-side the moulder prints a first part, and from this again is moulded a second part; these two half-moulds containing the working faces of two patternplates. Going back to the hard-rammed odd-side, two further parts, identical with the first prints, are made. These will be the under faces of the two plates. Up till now, nothing has differed from normal moulding practice.

The nine supports on the jig, which ultimately carry the nine bosses on the patternplate should now be made. It should be noted that these bosses are recessed some 60 mm. in relation to the top edge of the jig. This is necessary because sometimes the castings to be moulded on the plates are provided with substantial contours. These bosses are built up in several stages using a precision template; Fig. 4 shows one of the half-moulds for producing the under face of the patternplates on which has been placed such a template, located with pins on to the box-part. The first cutting of a supporting boss by means of a correctly-guided runner cutter is shown at A. At B, the print thus obtained is finished off using a runner cutter with a bottom blade so as to ensure a truly level surface at the bottom of the print. At C, this type of runner cutter has been replaced by a guide on which slides a runner cutter of reduced size, with which a reamering operation is carried out, going right through what remains of the sand. While this operation is carried out, the workman also imprints, by means of the two guides, D, the location of the prints used for centring the large bosses for the plate lugs. Finally, there is printed through the template components E, the bosses which set the position of the alignment references of the assembly. After the template has been removed, the part is finished, and is ready to receive the support components.

Fig. 5 is a large-scale reproduction of a section through one of the support components or bosses which includes a chill. The latter fulfils several functions, one of which is to give a clean machine-finished area to the patternplate at this point. A

FIG. 7.—*Details of the Vernier Gauge for Placing the Chills at the Correct Depth.*

second and more important function is the accurate setting of the height of this boss. Accordingly, the chill is accurately machined, both as regards thickness and on the supporting face. The chills are cast from the same metal as that used for the plate, and are made in different sizes according to the length of the boss for which they are to be used.

One of the chief features of this process consists of inserting into the prepared mould-part, shown in Fig. 4, pre-machined bosses to an exact depth in relation to the edge plate supports. A truncated steel core (B) is screwed at the centre of the chill, and will engage itself in the sand as and when required in the pilot hole provided from the jig. The fitting inside this pilot hole will be sufficient to ensure definite location of the chill. This digression is important in order to appreciate better the operations which will next be described.

Fig. 6 shows the same template as used for positioning the holes being used now for setting the chills. At A, the chill, carried on its siting button, is lowered into position. It is held inside the length-gauge by a copper tube (B) secured by forcing it on to the outside of the chill in the manner of a carrying spindle. At B, the chill is *in situ*, the steel cone with which it is provided being secured inside the pilot-hole, C. The chill thus positioned, is lowered to the true depth by employing a length gauge. The copper tube is then withdrawn by means of a sharp twist. The length gauge is then also removed. At D, the chill is in position, and will remain there. Fig. 7 shows details of the length gauge used for placing the chill at a true depth in its seating. The length of the chills is unfortunately quite variable (see Fig. 2), and it is necessary to bear in mind these differences in length, as they entail different contractions. The length gauge used for the siting is therefore provided with a vernier on which are inscribed the lengths of the bosses; this obviates the necessity for the operator to make calculations on the spot.

Flatness

Besides the nine support bosses of the central area of the plate, Fig. 3 shows a series of 32 small peripheral bosses for supporting the frame of the pattern-plate carrier or jig. These bosses are incorporated for two reasons:—(1) Spaces between the pattern-plate and the plate-carrier permit for the escape of the gas of the heating unit installed for warming up the patternplate in use. (2) If the joint of the plate

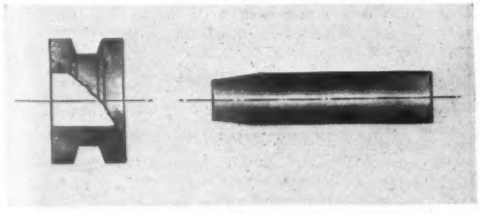


FIG. 8.—*Collar, kept in place by the Pin, for setting the Four Posts at E, Fig. 4.*

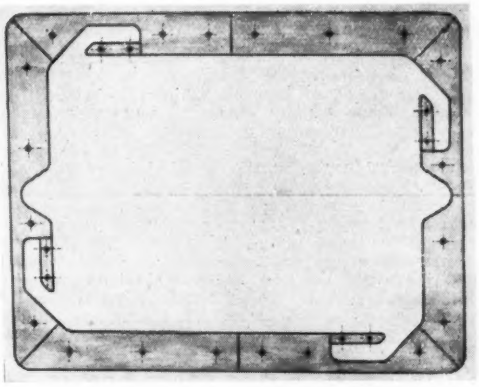


FIG. 9.—*Placing of Annealed Malleable Cast-iron Sections to form the Perimeter and Thickness of the Patternplate. Each segment is pinned into the Sand Mould.*

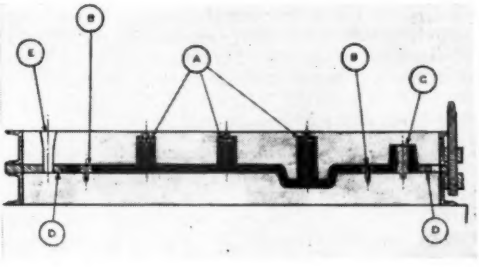


FIG. 10.—*Section through a Patternplate Mould after Inversion, Closing, and Casting.*

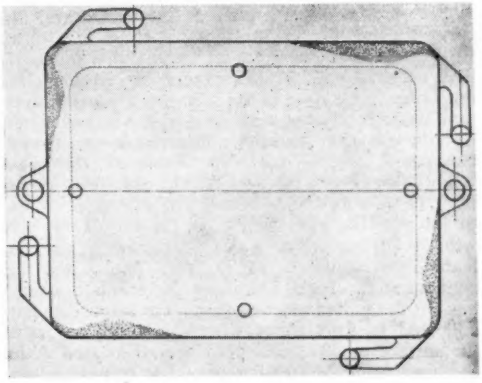


FIG. 11.—*Patternplate as Knocked-out from the Mould. Any Impurities collected at the Points shown are on the Sand Joint and do not affect the Serviceability of the Plate.*

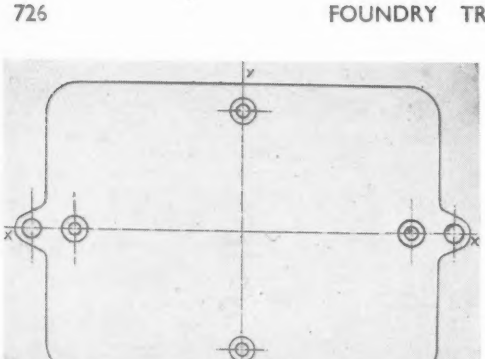


FIG. 12.—*Positions of the Four Location Pins on the Centre-lines of the Plate.*

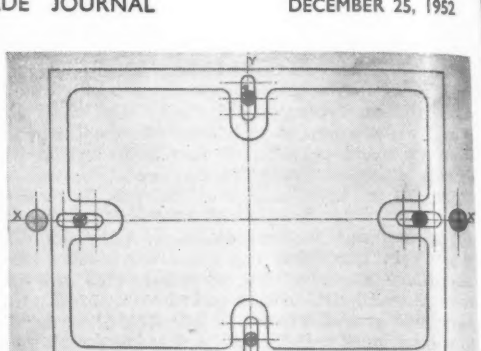


FIG. 13.—*Frame Template fixed on the Marking-out Table. Each oblong Hole ensures correct location in One Direction.*

is slightly deformed during the moulding and re-moulding caused by taking off four sand half-moulds, adjustment is not necessary along the whole length of the plate, but only at these points of reference in relation to the nine central bosses. These small peripheral bosses are thus printed in the mould when the chills are finally placed in position (Fig. 6). When, as is usual, it is necessary to correct the flatness of the joint, it is easier to work on the small bosses than along the whole periphery of the plate.

Assembly

The chills being *in situ*, it still remains to place in position the assembly components, of which further details will be discussed later, and which consist of a collar (see Fig. 8) which is maintained in place by a pin which slides freely whilst locking in the four posts shown at E, Fig. 4. The perimeter of the patternplate is then fixed by means of annealed malleable cast-iron segments, as shown in Fig. 9. They are divided into sections, each of which is held in place in the sand by two pins. The segments determine the outer profile of the plate, and also carry the ingates for the metal. These ingates are so arranged that the entry of the metal is tangential and in rotation. This arrangement confines any impurities remaining in the metal to the least important zone, that is, the sand joint of the future moulds to be made from the plate. The mould can then be closed.

Fig. 10 shows a section of the plate mould cast up. Three supporting bosses are shown at A; two of the pins for mounting at B; the lug of the plate with its adjustment core at C; a section of the malleable-iron segments at D; and one of the four runners at E. Fig. 11 shows a patternplate when it has left the mould after casting. The impurities have collected in four zones where they do not affect the surface quality, since they are all located within the sand joint. After the plate has thus been produced, the ingates are removed by sawing, and mounting can then be carried out.

Forming the Box-pin Holes

Fig. 12 shows the location of the four pins at right angles to one another within the plate. When joined in pairs, these four pins determine two lines bisecting one another at right angles, which give the true centre of one plate with another. This is independent of the sometimes irregular contractions of the plate. Fig. 13 shows the template fastened on to a marking-out table. It will be noted that this template is a frame in which four oblong grooves have been milled. Each one of these grooves ensures the correct location of one of the dimensions, to the exclusion of any compulsion in the other dimension. The assembly shows quite clearly the high degree of matching which is obtained through proper setting out. The marking off is shown in Fig. 14. An iron ring sliding on the gauge pins set in the marking-off table is placed in position at the desired height and the bush holes are closed by means of spring-loaded washers.

Casting.—After the moulding process has been finished, and the pin bushes in the matching plates cast-up simultaneously with metal from the same crucible (to reduce any differences due to contraction), the plates are then mounted on test plate-carriers.

Adjustment.—If cooling causes slight deformation, the plate is slowly adjusted by pressure until perfect alignment is obtained between the nine central bosses and those on the periphery. Generally, this operation gives the degree of accuracy required, and a perfect strip is usually obtained on the

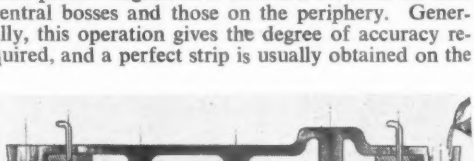


FIG. 14.—*Babbitting of the Pin Bushes after setting-up the Newly-made Patternplate by its Four Location Points. The Base of the Bush Mould is closed by a Spring-loaded Washer.*

trial moulds, with a casting section thickness corresponding to the original master pattern. The whole secret of success in this system is: "There is one crucial moment in the construction of two single-sided patternplates where the dimensions are truly exact. This moment occurs just before casting up. The correctly-established location devices can always be used to reset a plate which is slightly deformed after this very precise stage, provided they themselves are exact."

Results

In conclusion, it can be stated that:—(1) The plates are stronger, since the maximum unsupported span is only about 4 sq. decim. (60 sq. in.). (2) The plates can be rapidly moulded and adjusted. It takes two men six hours' moulding to make two single-sided plates of 40 sq. decim. (or about 600 sq. in.). (3) The adjustment is rapid. The finishing of the plate takes ½ hr. for marking-off for each plate, 2 to 3 hrs. of buffing and polishing, and perhaps 2 hrs. of final inspection using a scribing block. It should be noted that, if variations of thickness of 2/10* are allowed, there is no need for scribing-tool inspection, for it is exceptional that variations exceed 1/10.

The process has been developed by highly-skilled technicians, but the simplification of all the operations has made it so automatic that it is now possible to give the job of making these patternplates to any craftsman who understands hand-moulding. The fixed routine is therefore definitely laid down, for by its use, strong patternplates, capable of giving high-production yields, can be made—simply, rapidly, and with precision of the order of 1/10.

*It is presumed that these dimensional limits are expressed in millimetres ($\frac{1}{10}$ m.m. = 0.004 in. approximately).—EDITOR.

Conference on the Physics of Particle-size Analysis

There have been in recent years numerous publications relating both to the development of instruments and to the fundamental physics of the processes involved in measuring particle size, especially for sizes in the range of 0.1-30 microns. Measurement of particle-size distributions are made in many sciences and industries, and since it is now some five years since the last British conference on particle-size analysis (organized by the Society of Chemical Industry and the Institution of Chemical Engineers), it is felt that the time is now opportune for a further exchange of views. To this end, the Institute of Physics announces that it is arranging a Conference on "The Physics of Particle-size Analysis" to be held in the University of Nottingham from April 6 to 9, 1954. The synopsis of any proposed contribution should be sent before February 3, 1953, to the Conference honorary secretary, Mr. R. L. Brown, Institute of Physics, 47, Belgrave Square, London, S.W.1. Manuscripts should be sent in by the end of October, 1953.

Blind Risers

By "Tramp"

Blind risers or "pop-ups" are frequently employed on the rims of thin wheels, etc., to ensure that the metal runs up and completely fills the mould. Without their aid, the top edges of the rim may be irregular due to the pressure of the compressed gases in the mould not being able to escape freely through the vents. To enable this gas to be released the moulder often pushes a vent wire of about ¼ to ⅜ in. diameter through the mould. This is not good practice, as invariably the metal in the mould rushes up through these pop-ups and flows over the top of the mould. Also no effectiveness can be obtained from a riser on a central boss, due to the metal flowing through the pop-ups and not allowing of a build-up in the head.

To obtain the desired pressure due to the head of metal in the riser on the central boss and also to vent the rim freely, the "pop-ups" should not pass through the top surface of the mould but stop short, similar to a blind riser. Pop-ups should preferably be formed by means of a rectangular-section tool, such as the blade of a cleaner, rather than a wire, the reason being that a circular section has the least perimeter for its area and thereby stays molten much longer than a rectangular section. The evacuation of gas and not the continued passage of metal is the end desired. Pop-ups are very useful in the foundry, but their usefulness may be impaired by forming them carelessly.

Cast Crankshaft Design

An investigation has been made of the influence of some special design features on the bending fatigue strength of cast crankshafts and reported in publication 1951/2 of the Motor Industry Research Association, by R. I. Love. His synopsis runs as follows:—

From time to time, various special design features have been suggested for incorporation in cast crankshafts to improve their strength, and the fact that these modifications can be introduced readily by the casting process has often been claimed as one of the advantages of this type of production. The present investigation was concerned with the following special design features: "web depressions," journal bores with well-rounded ends, journal bores with ends reduced in diameter, chamfered webs, eccentric journal bores, and slots machined through the web. Some of the designs were subjected to bending fatigue tests and others were more conveniently examined by stress measurement.

None of the designs gave increases or decreases of strength of appreciable magnitude and the best improvement indicated, with the journal bores with reduced ends (or "barrel-shaped" bores), was only of the order of 10 per cent. This is negligible compared with the considerable improvements of strength obtainable by increasing the fillet radii, as had been shown in earlier work. However, some of the designs did have an appreciable effect on crankshaft bending flexibility. For example, "web depressions" increased the flexibility by about 50 per cent.

A PLANT for the production of alumina, the oxide from which aluminium is made, has come into operation in Jamaica. Worked by Alumina Jamaica, a subsidiary of the Aluminium Company of Canada, the plant will have an initial production of 120 tons a day, which will be expanded later to 450 tons a day.

E

Influence of Blast-furnace Slag on Pig-iron

Suggested Occurrence of an "Inertness Temperature" in Slag Reactions

In an article* on the influence of the mass and nature of slag on pig-iron production in the blast furnace, the French author, Mr. J. G. Platon, attempts to establish what is believed to be a new conception of an "inertness temperature" of slag in contact with coke. He records some known facts and attempts to develop them on a theoretical basis. What follows are extracts from his theories which may have significance also in considering cupola reactions.

Slag directly influences the nature of pig-iron, *i.e.*, without passing through complicated intermediate stages, by its melting point, composition, and mass. If the melting point of the slag is low, it quickly fuses, and with ferruginous material in course of transformation, passes rapidly through the coke column in the furnace, descending more quickly than the coke charged at the same time as the constituent raw minerals. The slag and iron ore being transformed thus arrive prematurely at the bath in the furnace bottom and are not heated to the temperature they would have reached during a more leisurely descent. The melting point of the slag gives the main control of this action and indirectly affects the temperature of the pig-iron.

Iron/Slag Equilibrium in the Hearth

The composition of the slag has an influence on the iron/slag chemical equilibrium and, at the same time, on the carbon/slag equilibrium, but to different extent. The first of these (iron/slag), if completely independent of the carbon/slag equilibrium, would be substantially without effect on the iron, because of the stability of the diluted elements of the iron with the combinations or multiple mixtures of silica, lime, magnesia, etc., of the slag. The contact would only affect the distribution of certain individual compounds (oxides or sulphides) of elements contained in the iron (Fe, Mn, Si, etc.). It is known, for example, that acid slags have a higher iron-oxide content than basic slags. The quantity of slag also has its effect, particularly in connection with sulphur distribution.

On the whole, the effects of the iron/slag equilibrium are secondary by comparison to those of the carbon/slag equilibrium—or rather the lack of equilibrium—which is the main factor in the working of the blast furnace below the tuyere level.

The main use of the carbon/slag equilibrium is decomposition by carbon (with or without gaseous intermediaries) of the less stable oxides, *i.e.*, FeO, and then in particular SiO_2, P_2O_5, and MnO. As long as the temperature is sufficiently high, the reduction of, say, SiO_2 continues.

The quantity of coke is practically unlimited in relation to the quantity of slag. The reaction cannot therefore be stopped by reason of the exhaustion of the coke.

$$SiO_2 + 2C = 2CO + Si - 138 \text{ cals.}$$

For this reaction to cease, it would be necessary for the slag temperature to be reduced to such a value that the silicates or the silica of this slag would be no longer reducible. This point alone, *i.e.*, a certain precise temperature for a given slag analysis, provides the key to the composition of the iron at a given moment during reduction in the furnace hearth.

Limitations

Now, in order to lower the slag temperature by, say, 150 deg. C., it suffices to extract from it about 1 kg. × 0.26 × 150, *i.e.*, 39 cals. per kg. This corresponds, at the very most, to the reduction of 18 gm. SiO_2, or to the introduction into the pig-iron of 8 gm. Si (0.8 per cent. silicon in the iron). For a slag which would contain 36 per cent. SiO_2 before this reduction, the silica content would be reduced to no further than 35 per cent. If the same calculation be made for phosphorus, it is found that the introduction of 2 per cent. P into the pig-iron corresponds to a reduction of about 270 deg. C. in the temperature of the slag.

With the direct reduction of FeO, similar relations exist as to the difference between the temperatures of the gas at the level of the tuyeres and the temperature of the liquids (iron and slag) in the hearth. Thus the composition of the iron is governed by the arrest of the direct reductions as soon as the slag falls to its "temperature of inertness in contact with the coke." Theoretically this temperature should be attained, and the slag should not fail to reach it, if the slag stays sufficiently long in the furnace, which does not always happen.

The Author then goes on to discuss the reactions in relation to furnace conditions favouring the production of "hot" and "cold" and "dirty" iron from the furnace and concludes with the following statement:—

Efforts to influence this phase of blast-furnace working can do no more than:—(1) Affect the preceding phase so that the hearth is reached in the condition most close to what is desired; (2) influence the stage of direct reduction itself either by hastening or retarding it. Above hearth level, there is only one problem with a given charge—that of heating the iron and the slag in their period of formation to the desired extent, in general, as much as possible. At hearth level the nature of the iron can be influenced only by controlling the efficacy of the coke itself on the slag. But, in general, these two modes of operation within the furnace are distinct.

* Published in our sister journal, *Iron and Coal Trades Review*.

THE TRADITIONAL CEREMONY of relighting the No. 2 blast furnace of the Staveley Iron & Chemical Company, Limited, Chesterfield (Derby), which had been relined since it was blown out on October 8, was performed last week by Mr. M. C. Hanna, a director of the company.

Synthetic Resins as Sand Bonds*

By P. G. Pentz, B.Sc.

In a Paper of similar title presented at the British Plastics Convention in June, 1951, the subject was reviewed in a way intended to be intelligible to people familiar with synthetic resins, but unacquainted with the details of foundry practice. To many in the chemical industry ,of which the plastics industry is a part, foundries are places of mystery, in which demons labour amid smoke, flame and molten metal to produce castings of weird and intricate shape. The present Paper is addressed to the demons and will, therefore, approach the subject from a different angle. It is proposed to deal briefly with the characteristics of synthetic resins as such, in order that their behaviour in the foundry may be better understood; then to discuss the performance of current types of synthetic resin under actual foundry conditions, with emphasis on such practical difficulties as have been encountered; and finally to mention some of the more promising developments now taking place both in the characteristics of the resins themselves, and in the methods of using them in the foundry.

The first thing to note about synthetic resins is that they are *synthetic*. The implications of this somewhat obvious fact are not yet adequately appreciated by foundrymen. In synthesizing a resin, the chemist commonly starts with relatively simple chemicals (often themselves synthetic products, like urea, phenol, formaldehyde) and by appropriate chemical processes builds them up into new molecules of much greater size and complexity. By varying the proportions or the conditions under which his raw materials are reacted, the resin chemist can adjust the molecular shape and size, and therefore the chemical and physical properties of his final product, almost at will. Within limits, resins can be constructed so as to have predetermined properties. When the resin manufacturer knows precisely what properties are needed to fit his resin to a particular job in a foundry, he can fashion it accordingly. "*Synthetic resins,*" then, are chemicals built to order. But why "resins"? Largely because they have some at least of the properties of the natural resins found in the vegetable world, among which the best known, perhaps, is colophony ("rosin"). They are viscous, non-crystalline liquids or semi-solids, usually thermoplastic up to a point; this is, they become more fluid, at least temporarily, when heated; and they show strong cohesive as well as adhesive power. The synthetic resins used in foundry sand-bonding all have a characteristic which distinguishes them sharply from natural resin: they are permanently and irreversibly hardened by heat—in other words, they are thermosetting.

Classes Available for Foundrywork

Of the many different classes of synthetic resins available, only two are at present important as foundry sand binders. These are the urea-formaldehyde (U.F.) and phenol-formaldehyde (P.F.) resins. It is unlikely that the other thermosetting resins now known, such as melamine and resorcinol resins, will find any large-scale use as sand binders, mainly because they cost too much to make. The U.F. resins employed for this purpose to-day are usually supplied in the form of liquids of fairly low viscosity, containing about 50 to 55 per cent. resin solids, the balance being water. They thicken slowly during storage, but can normally be kept for at least six months under reasonably cool conditions. These resins are usually designed specifically for foundry use, and differ appreciably from the U.F. resins employed in other industrial applications such as wood gluing and textile finishing. The differences between the various brands of liquid U.F. resin now being marketed in this country as sand binders are, from a practical point of view, relatively slight, though quite significant in certain critical uses.

U.F. Resins.—The more important properties common to all U.F. resin binders are adequately described in the Report of I.B.F. sub-committee T.S.30 on which the Author had the privilege of serving. This Report, entitled "Synthetic Resins in the Foundry," was presented at the annual conference of the Institute in June last year. The Author can do no better than to refer readers to the Report for details, and will confine himself here to noting the salient characteristics of U.F. resins. These are:—

(1) Conversion of the resin from the water-soluble liquid form into an insoluble, infusible solid by the application of heat.

(2) This hardening or curing of the resin takes place much more rapidly than the oxidation and polymerization of drying oils, like linseed oil, with consequent large savings in baking time and fuel consumed in foundry ovens. At temperatures above 170 deg. C., U.F. resins begin to decompose.

(3) U.F. resins are ideal for high-frequency baking, because they require relatively little electric power to effect rapid curing, and the danger of over-baking is eliminated.

(4) Formaldehyde gas, which is irritating, is evolved during the curing of the resin, but should present no practical difficulty, as it is removed by the oven ventilating system and the fully-baked core has no residual odour of formaldehyde.

(5) The rapid breakdown of U.F. resins at casting temperatures distinguishes them from P.F.

* Paper read to the Sheffield branch of the Institute of British Foundrymen. The Author is technical sales manager, Leicester, Lovell & Company, Limited.

resins or oil-binders, and permits much easier removal of burnt core-sand. There is a possibility of premature core collapse with heavy-section castings at high temperature.

(6) Partial decomposition, either by over-baking or from the heat of the molten metal, produces breakdown products of somewhat unpleasant odour characteristic of all U.F. resins without exception.

(7) U.F. resins produce about as much gas as linseed oil, but it is evolved much more rapidly.

P.F. Resins. The term phenol-formaldehyde resin is somewhat misleading because "phenol" may refer either to hydroxy-benzene or to one of its homologues, or to mixtures of these phenols. Meta-substituted phenols, such as meta-cresol, react with formaldehyde in much the same way as ordinary phenol, and produce resins with quite similar properties. For technical and economic reasons, the higher phenols are attractive raw materials, and much work has been done with them. Since the resin chemist has at least a dozen phenolic raw materials commercially available, either singly or in various combinations, there is clearly the possibility of a much greater variety among phenolic resins in this broad sense, than among the urea-formaldehyde resins. In consequence, it is more dangerous to generalize about P.F. resins. However, it can be said that the P.F. resins in current use as foundry sand binders generally have the following properties in common:—

(1) Like U.F. resins, they are hardened by heat, becoming insoluble and infusible.

(2) They normally require rather more heat than U.F. resins to cure them, but are still much quicker than linseed oil, and will actually tolerate more over-baking than oil, without serious loss in strength.

(3) They require somewhat more high-frequency heat than U.F. resins.

(4) The removal of excess formaldehyde during baking is, for practical purposes, the same as with U.F. resins.

(5) The rate of breakdown after casting is much slower than for U.F. resins, and about the same as for linseed oil.

(6) P.F. resins are outstandingly good in regard to the odour of their thermal decomposition products which are far less unpleasant than those from oil or from U.F. resins. The quantity and rate of evolution of gas during castings are both exceptionally low.

Over the last four or five years, some thousands of tons of U.F. and P.F. resins have been used in British foundries, and valuable experience has been gained, not only by the progressive foundries that have used the resins, but also, and equally important, by the resin manufacturers. There is now a much wider appreciation among foundrymen of the advantages which synthetic resins can provide. It is intended to deal mainly with such difficulties as have been encountered in foundry practice.

Application to Corebinding

Experience has shown clearly that U.F. and P.F. resins can generally be regarded as complete substitutes for linseed oil, but not necessarily for semi-solid core-compounds. In other words, the resin binders can be relied upon to provide adequate dry-strength and hot-strength, but not necessarily green-strength. Other ingredients, such as cereals, are normally required to impart the plasticity, green-bond, and freedom from stickiness so essential to satisfactory coremaking. It is indeed primarily the properties of resin-bonded sands in the "green" state which have proved most difficult to perfect.

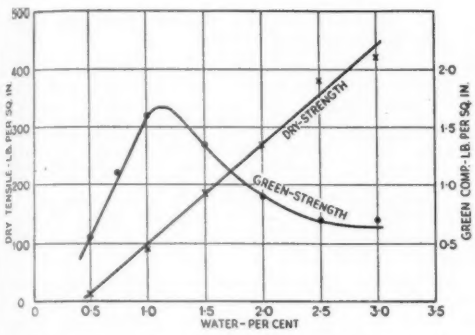
The normal ingredients of what may now be considered a conventional resin-bonded core-sand, are silica sand, cereal powder, water, and liquid resin. If a high green-bond (green-compression strength of 2 lb. per sq. in. or more) is essential to prevent sagging, or to permit safe handling of the green core, an addition of fine sand, clay, or naturally-bonded sand is made. Paraffin oil, or one of the more effective surface-active materials, supplied as proprietary liquid parting compounds or release agents, may also be needed to improve flow properties and facilitate clean stripping from coreboxes. Each of these ingredients has an effect on the properties of the resultant mixed core-sand and of the baked cores, so that the proper formulation of the mix is a somewhat complex matter on which it is difficult to generalize.

Most liquid resin binders add little to the green-strength; indeed, they frequently reduce it. If, for instance, water is added to a sand/cereal mix in such a proportion as to develop maximum green-strength, the green-bond will drop noticeably on further addition of a water-soluble P.F. or U.F. resin. These resins, in fact, behave in this respect like an equivalent quantity of water. To obtain maximum green-strength from the cereal present, it may, therefore, be necessary to use less water in the presence of resin. From the point of view of dry-strength, precisely the opposite is desirable: the higher the moisture content, the better the dry-strength. For this reason, water soluble U.F. or P.F. resins are easier to use, and are more economical for core-sands of low green-strength. Fig. 1 will illustrate this point.

The plasticity that enables the core-sand to be moulded easily to shape in a corebox is quite readily obtained in normal sand/cereal/resin/water mixes. It is, however, a characteristic of the synthetic resins used up to now that they tend to produce rather tough sands, *i.e.*, they are often a little more difficult to ram than an oil-bonded sand having the same green-compression strength. This greater toughness can be measured by means of the shatter test, and increases with milling or mixing time, even when there is no corresponding increase in green-compression strength. The reason for this behaviour has been obscure, but some research work now in progress holds promise of explaining it.

Flow Problems

This toughness in resin-bonded sands is seldom sufficient to cause practical difficulty in hand-



Mix: Southport Silica sand ... 100 parts by weight
Cereal ... ... 1.5 " " "
U.F. Resin (liquid) ... 1.5 " " "
Water ... ...

FIG. 1.—*Effect of Water Content on Green-strength and Dry-strength of a U.F.-resin Core-sand.*

rammed cores, but is sometimes noticeable in large cores of such a design that some of the sand has to be tucked into the sides of the boxes and cannot be subjected to a direct compaction under the blows of the rammer. Poor compaction means reduced dry-strength with resin-binders just as it does with oil-binders. A practical example of this may be found in an ironfoundry in the Midlands making cores weighing 50 to 100 lb. in core-sand bonded with phenolic resin. The dry-strength and surface hardness of transverse test pieces, made in the coreshop from the normal mix and baked in the foundry oven alongside the large cores, are consistently better than the strength and hardness of the production cores themselves, particularly in those parts where compaction results only from a secondary sideways thrust. It must be said, however, that in this particular case, part of the toughness of the sand may be due to the presence of a high proportion of sub-angular sand grains, and should not all be attributed to the resin.

Similar flow problems arise in extruding and core-blowing, partly as a result of the characteristics of ordinary resin binders and partly in consequence of the higher moisture content (compared with oil) at which the resins are normally used. Nevertheless, by a suitable adjustment of the ingredients and the use of special parting compounds, it has been found possible to overcome these obstacles, and to blow or extrude resin-bonded cores of all types.

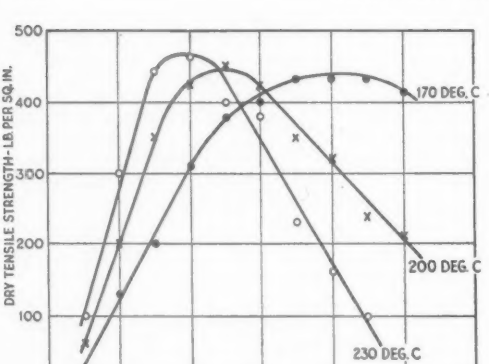
When attempts were first made to use synthetic-resin binders on a production scale, considerable difficulty was encountered due to the tendency of the resin-bonded core-sand to adhere to the sides of the corebox. Since those early days, efficient release agents have been developed, usually in the form of liquid parting compounds, which, together with suitable formulation of the core-sands and to some extent improvements in the resins themselves, have virtually eliminated any troubles of this sort. Resin-bonded sands in foundry use to-day are, if anything, less sticky than the oil-sands they have replaced. They also leave the coreboxes far cleaner. Many oil-sands, as is well known, tend to build up a substantial film on the surface of the box which leads to trouble if the box is not periodically taken out of production and thoroughly cleaned. Metal boxes are generally preferred as giving the best strip with difficult cores. Aluminium, possibly because of surface oxidation and other characteristics, is sometimes less suitable than iron. Wooden boxes are satisfactory when smooth, but certain types of corebox varnish are softened by phenolic-resin binders, and this may lead to "clagging." The remedy is to use a varnish which is resistant to the resin.

Bench Life.—The bench life of a resin-bonded sand is usually far better than that of the oil-sand it replaces. Provided the core-sand is covered with a damp sack or other appropriate means are used to prevent loss of moisture, most resin-bonded sands can be kept for a week or more without significant change in properties. Air-drying, on the other hand, proceeds rapidly at the surface of the "green" core. This effect can be seen readily if green-compression test-cores are left to air-dry for various periods before testing.

Drying of Resin-bonded Cores

The drying of cores bonded with P.F. resins has never presented any practical difficulty, since these can be subjected to normal oil-drying cycles without damage. The usual practice when introducing P.F. resin into the coreshop has been to make appropriate alterations in the core-sand mixing formula, but to make no further alterations in normal coreshop practice, so that the resin-bonded cores were subjected to exactly the same conditions as the oil cores. Having established that the cores and castings so produced were satisfactory and put the P.F. resin into general use, the coremaker has then proceeded to the next step of reducing the baking cycle and sometimes the temperature as well.

With U.F. resin binders, it is not always possible to bake the cores at the relatively high temperatures often used for oil-bonded cores, because of the serious over-baking, particularly on corners and small projecting pieces, which is liable to result. In this connection it is essential to understand that it is not the oven temperature as such which determines whether or not a core will be over-baked. It is the combination of temperature and time in relation to the mass of the core, its surface area and its initial moisture content. The larger the core and the more water it contains when it enters the oven, the longer, clearly, it will take to reach a temperature high enough to cause decomposition of the resin, *i.e.*, over-baking of the core. A large U.F.-bonded core, weighing about 200 lb. and of fairly uniform thickness is being produced in large numbers from a continuous oven, running at a top temperature of about 285 deg. C. with a cycle time of about two hours. A 1-in. tensile test-core of the same composition would be over-baked if subjected to this high temperature for more than 15 min. A graphical representation of the relationship between temperature and time can be seen from the curves shown in Fig. 2.



Mix: Southport Silica sand ... 100 parts by weight.
Cereal ... ... 1.5 " " "
U.F. Resin (liquid) ... 1.5 " " "
Water ... ... 2.0 " " "
Parting compound ... 0.25 " " "

FIG. 2.—*Time/Temperature Drying Cycles for U.F.-resin Cores.*

It is clear that the thickness of the core is also of major importance in determining the amount of heat it can take without over-baking. Cores in which the surface area exposed to the hot oven-gases is large in relation to the weight of the core will obviously be more prone to over-baking; *i.e.*, they will demand either a shorter baking cycle or lower temperature.

In dealing with the general characteristics of these resins, it was mentioned that the fully-baked core was free from any residual formaldehyde. In practice, it is sometimes unnecessary to bake cores throughout, adequate strength being obtainable in many large cores by curing the resin in the oven to a depth of only an inch or so. Such cores emit formaldehyde fumes from the uncured resin in the interior, and this may be unpleasantly noticeable on removal of the cores from the oven. The residual heat is usually sufficient to harden the resin inside the core during the period when it is cooling off, and any inconvenience from the formaldehyde fumes at this stage can be avoided, either by arranging suitable ventilation or by adding to the initial sand mix a substance which will absorb excess formaldehyde and accelerate the hardening of the resin.

Check on Proper Baking

A practical question in regard to baking which is often asked, is whether there is any simple and satisfactory means of judging when a resin-bonded core is fully baked, in view of the fact that there is little or no change in colour. In repetition work, the best means of controlling baking is usually to determine by experiment the optimum baking time for any given type of core under constant heating conditions. Where there is substantial variation in cores made from day to day and possibly in oven conditions also, the following criteria may be used:—

(1) Fully-baked cores no longer have the sharp smell of formaldehyde when hot.

(2) Over-baked U.F. cores have the characteristic odour of burnt U.F. resin and are progressively darker in colour according to the degree of over-baking. P.F. cores also become darker in colour when over-baked, but the difference is not so marked, and there is no noticeable difference in odour.

(3) Probing into a core-print will show whether the interior of the core has received enough heat to harden the resin.

A characteristic feature of properly-baked resin-bonded cores, is that the hot core on removal from the oven has nearly the same strength as after cooling. This property, together with the speed at which the "green" core hardens during the early stages of baking, reduces the tendency to distortion, so that greater dimensional accuracy can be obtained. In this connection, it must be borne in mind that swelling of the cereal powder by absorption of water may cause some expansion of the core in the green state, so that the baked core is sometimes slightly larger than the freshly-made green core. Experience has shown that the difference in dimensions is very slight, and can usually be ignored.

In jigging baked cores to precise dimensions, difficulty is sometimes encountered with breakage of resin-bonded cores, whereas oil-bonded cores of the same dry-tensile or -compression strength can be jigged without damage. This is sometimes associated with the fact that the oil-bonded core is slightly plastic, while hot, so that the bond between the sand grains is relatively tougher and less brittle than with resin. This seems at present to be an intrinsic characteristic which cannot be removed. Normally, however, it is possible to avoid any wastage of cores in jigging, either by working at a somewhat higher dry-strength or by using less violent methods of jigging.

Skin Hardness, Jointing and Moisture Resistance

Resin-bonded cores sometimes show excellent skin hardness, but friability beneath the surface, and this may be a disadvantage when it is necessary to rub down the baked core in order to trim it to size. This effect is usually attributable to the migration of resin from the interior to the surface of the core during baking, and may be controlled by appropriate adjustment of the core-sand mixture. It is by no means an inevitable characteristic of resin-bonded cores.

The jointing of half-cores can be done in the normal way without difficulty. The use of a core paste based on synthetic resin makes it possible to joint cores rapidly without re-drying.

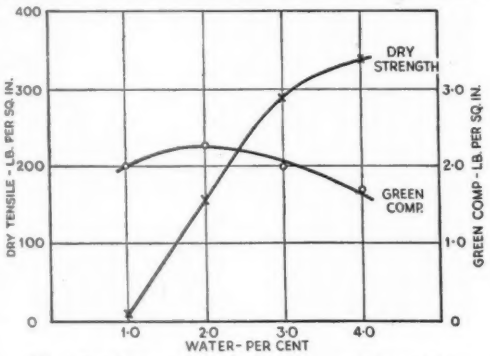
The moisture resistance of resin-bonded cores is usually good, and it should be possible to leave them in green-sand moulds, or to store them for several months in the coreshop, without significant loss in strength or surface hardness. It is dangerous to generalize on this point, however. The moisture resistance is greatly affected by the proportion of cereal or other water-absorptive materials present in the original core-sand.

Casting

No particular difficulties have been encountered during the actual casting operation using resin-bonded cores, except those naturally resulting from improper formulation or neglect of the fairly obvious precautions already dealt with. The very low gas-content of cores bonded with phenolic resin and little or no cereal naturally makes this type of binder ideally suitable for castings where minimum gas evolution is an important requirement. The casting finish obtained from suitable resin-bonded cores is (according to most foundrymen able to speak from experience) noticeably better than from oil-binded cores. In some cases, particularly steel castings with P.F. cores, the improvement in casting finish has been quite remarkable. U.F. resins are generally found to produce a striking reduction in finning with consequent savings in fettling costs.

The amount of smoke and fume is often noticeably reduced when resin-bonded cores are used. One has, of course, to allow for the smoke produced from the decomposition of any cereal present as well as from the resin itself. In some foundries, the improvement in foundry atmosphere resulting from the use of a resin binder has been sufficient inducement on its own to effect a change from oil to resin.

Recent advances in liquid resin binders have been mainly in the direction of improving the characteristics of the "green" core-sand. There are now available resins, particularly P.F. resins, which provide substantial green-bond, thus reducing or even eliminating cereal, with consequent saving in cost and reduction in gas content. The flow properties of the sand are also much improved, partly as a result of the altered properties of the liquid resin, and partly as a result of the lower moisture content at which these new resins can be used in clay-free sands without sacrificing dry-strength. As is shown by Fig. 3, a resin of this type still shows a rapid increase in dry-strength with increasing moisture content. The green-strength, however, does not fall off seriously, partly because the resin in the mix is contributing green-bond as well as the cereal. In this particular mix, if the cereal be omitted, the green-compression strength at 2 per cent. moisture content is 0.65 lb. per sq. in.—about 30 per cent. of the total. By contrast, the green-strength in Fig. 1 showed a peak at 1 per cent. moisture content and fell off rapidly, being reduced to only half at 2 per cent. moisture content.



Mix: Congleton sand ... ... 100 parts by weight.
Cereal ... ... 1.0 " " "
P.F. Resin (new type) ... 1.5 " " "
Water ... ...

FIG. 3.—*Green-strength/Dry-strength Relationships for a Special P.F.-resin Corebinder.*

The small proportion of clay present in the Congleton sand referred to in Fig. 3, increases the green-strength, but reduces dry-strength, and therefore necessitates a mix of higher moisture content. Less-moist sands are generally desirable because they tend to be more free-flowing, thus facilitating coremaking generally. The "blowing" of complex cores in resin sand is likely to be greatly simplified by the new resins.

Shell Moulding

Possibly the most important advance in sand-bonding lies in the production of moulds and cores in the form of thin shells, through the use of finely powdered resin intimately mixed with fine sand. This process employs a different type of resin, and bears little relationship to the conventional resin-bonded core-sand technique, except for the use which is made of the rapid thermosetting characteristics of the synthetic-resin binders. Shell-moulding has become a subject large enough to deserve individual treatment, and it will not, therefore, be discussed here.

Economics

A word must be said about the economics of liquid resin binder use. U.F. resins of 50 to 55 per cent. solids content now cost about £65 to £70 per ton, according to quantity, whilst cereal powder costs about the same. For a clay-free sand giving a green-bond of say 1.0 lb. per sq. in. and dry-strength of 250 lb. per sq. in. tensile minimum, binder cost would work out at approximately £170 per 100 tons of core-sand, or £1 14s. per ton. Usually the cost with U.F. resin is very definitely less than with oil, even without taking into account the economic value of shorter baking time, less fuel, less wastage, easier knock-out and less fettling. P.F. resins are made from more expensive raw materials and therefore cost more than U.F. resins per pound. Usually the total binder cost per ton of mixed core-sand is slightly higher for P.F. than for U.F., though often still cheaper than core-oils and compounds. Here again, the technical advantages offered by the synthetic-resin binders may be far more important than the direct saving in binder costs. The latest type of P.F.-resin binder, by reducing or eliminating cereal, may be able to compete with U.F. resins in direct binder cost per ton. All the raw materials used in making these U.F. and P.F. resins are produced in the United Kingdom. Adequate supplies are available, and there should be no serious difficulty in providing sufficient extra resin to replace all the linseed or similar drying-oils now in use.

Publications Received

The Fight Against Rust. The work of the Corrosion Committee of the British Iron and Steel Research Association, 11, Park Lane, London, W.1. Price 2s. 6d. post free.

It was the late Sir Robert Hadfield who first stressed the enormous loss suffered by industrial countries every year through rust. This pamphlet, in simple language, outlines the problems, cites some outstanding cases, and then details what is being done to improve matters through intensive research. It is quite a "readable" booklet of an essentially reliable character.

Journal of Research and Development. Vol. 4, No. 8. Published by the British Cast Iron Research Association.

This issue contains two articles: one on the influence of the sulphur/manganese ratio on the occurrence of mottle in whiteheart malleable iron by Mr. S. W. Palmer, and the second on a study of some metallurgical factors in cast iron by Mr. W. J. Williams. Mr. Palmer shows how, by adjusting the composition—that is by slightly lowering the carbon and silicon contents—the tendency to mottle may be offset. The second article correlates such factors as super-heating, inoculation, melting stock with oxygen and the chilling properties of low-silicon cast iron.

Accidents—How they Happen and How to Prevent Them. Vol. 13, Oct.—Published for the Factory Department, Ministry of Labour and National Service, by H.M. Stationery Office, Kingsway, London, W.C.2. Price 9d. net.

There is one foundry accident reported in this issue. It was caused by a 4-ton ladle leaking during a half-hour standing period. Instead of removing the ladle to a dry position in the foundry, the leakage finally developed near a bosh and so caused an explosion. The comment on the accident says that the furnace conditions should be adjusted so as not to give a metal so hot that the ladle needs to stand. In the reviewer's opinion this is poppycock, and the crux of the matter is a properly lined and dried ladle.

American Accident Prevention. A Summary of a Report by A. Elson and P. Wright to the Publishers—The United Steel Companies Limited, 17, Westbourne Road, Sheffield 10.

Conditions in foundries, so far as accident hazard is concerned, are not so very different from steel works, and much good can be derived from a study of this Report. The reviewer thought when reading many of the productivity reports that a special study of industrial accident prevention would be of use, and now that this report is available he is confirmed in that opinion. The American approach to the problem is quite different from the British, as here state legislation replaces much excellent voluntary and individual effort. Close following of the American system would reduce the need for legislation, as has in recent years been shown by the foundry industry in giving attention to modern notions.

Danger Figures for Production Management. Published by the Institute of Management, 8, Hill Street, London, W.1. Price 3s. 6d.

This booklet is worth studying by the busy executive in charge of a medium-sized factory, as it discloses a system whereby this individual can quickly learn the weaker sections in his organization. Obviously some preliminary work has to be undertaken to form a basis for comparison. For instance, if a machine is scheduled to give 500 moulds per week and only 420 are produced, the loss can be attributed to either plant problems or labour inefficiency. By assembling all the units of production and then breaking down the causes for any low output, a picture is given of what is wrong. Usually the "boss" knows all about the result of a power cut or a major breakdown, but by pursuing the system disclosed, knowledge of smaller happenings—which in the aggregate are important—is brought clearly into the limelight.

Victoria—Australia, State of the Golden Future. Published by the Australian Publicity Council (Victorian Division), 375, Collins Street, Melbourne, C.1, Victoria, Australia.

The first publicity book the reviewer read which dealt with Australia was called the "Kangaroo Keeps on Talking." That was about 30 years ago. From then onward the illustrations have been improving in quality, but for a period too much stress, perhaps, was laid on sport and insufficient on cultural activities for the no-longer young, whilst the industrial growth reported was usually just a few years behindhand.

In this latest publication, proper balance has been achieved; illustration has been so improved as to warrant the appellation "near perfection." The publication has been prepared with the Olympic Games in mind, but there is an appeal to the industrialist and technician. It no doubt is available to readers on writing to Mr. Athol E. Turner at the address quoted.

The illustration shows a Francis Runner weighing 7 tons and cast in Stainless Steel, having a tensile strength of 30 to 35 tons per sq. in. It was supplied by the David Brown Foundries Company for the Fasnakyle power station, part of the £8,000,000 Glen Affric hydro-electric scheme.

Wooden and Metal Dowels

By "Checker"

Both wooden and metal dowels are often made use of in patternshops for holding pieces of wood together either temporarily or permanently. Various sizes are used according to the thickness and type of work to which they are to be applied. Metal rods are mostly used, of mild steel, $\frac{1}{4}$ in., $\frac{5}{16}$ in. and $\frac{1}{2}$ in. dia.; from these, the patternmaker cuts off the lengths he requires. Wooden dowelling is generally of larger diameters, $\frac{1}{4}$ in. $\frac{3}{4}$ in., and $\frac{1}{2}$ in. being the most common sizes used, while occasionally on larger work it may be an advantage to use dowelling of $\frac{3}{4}$ in. dia.

With many patterns and coreboxes that must be made in halves, and from which only a small number of castings are needed, wooden dowels are used to hold the two halves together. The holes for these can often be drilled when both halves are together, thus, by ensuring that the correct positions are easily and accurately obtained. All dowels used for this purpose should have their protruding ends tapered to give a good lead, and to ensure an easier fitting of both halves as shown in Fig. 1. It is essential that all wooden dowels should be glued in position in the one half.

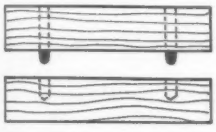


FIG. 1.—*Fitting of Locating Dowels for Patterns.*

Occasions often arise when the patternmaker has to make a pattern from two or three pieces of wood, with their joints corresponding with some definite part of the pattern shape. It is therefore an advantage for him to be able to work the various shapes separately, before these pieces of wood are finally glued together. This can be achieved by dowelling the different sections in position, for then he can remove the parts, each piece separately, as desired. It also ensures accurate replacement, however frequently the work is taken apart. For all joints, at least two dowels are necessary, and it is also an advantage to use metal instead of wood in these instances. Dowels often have to be removed a number of times while the various shapes are being cut, therefore the advisability of using the harder-wearing metal dowels is obvious. Extra length should be allowed to protrude above the pattern face, and so give a suitable grip for pliers or pincers for temporary removal of the pin.

Sometimes the retention of metal dowels is not required after the final construction of the pattern has taken place. In these circumstances they can be withdrawn as soon as convenient after the various components have been glued together. It will be found that, over a period, a number of differently sized dowels have accumulated, which can be utilized on future work. However, when metal dowels must be finally fixed in the pattern, the excess length, of course, is sawn off and the ends carefully filed to blend with the pattern shape.

Blind Holes and Special Cases

Fig. 2 (*a*) illustrates in section how two pieces of timber could be dowelled together with the dowel holes continued only partly and not right through the second piece. Fig. 2 (*b*) shows how three pieces of wood can be dowelled together, with dowels penetrating right through the second piece into the third. An alternative method for use on many occasions is shown in Fig. 2 (*c*). This has dowels on both sides for holding the outer parts to the centre portion.

With many angular-shaped patterns, it is a distinct advantage to make them from separate pieces, so that accurate pattern shapes can be marked on all joint-faces and worked to size individually. Fig. 3 shows a pattern before the final shapes and contours have been made. It was made in halves, each half comprising three pieces. For easy and also accurate working, the end-flanges were made separately and fixed to the centre portion with metal dowels as shown. It is important that great care should be taken to ensure dowels are placed in the best possible positions. Occasionally it may be found that a little more care or

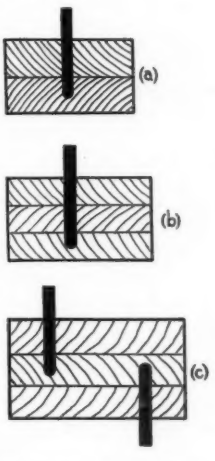


FIG. 2.—*Various Methods of Dowelling Two- and Three-part Timber.*

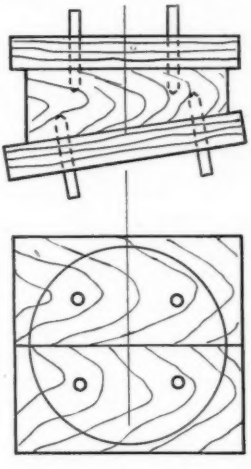


FIG. 3.—*Dowelling of Asymmetrical Parts to Permit Separate shaping.*

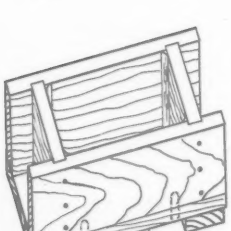


FIG. 4.—*Dowelling of a Frame Corebox through the Bottom into the Sides.*

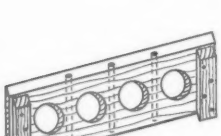


FIG. 5.—*Top-piece of a Corebox reinforced by insertion of Dowels.*

forethought would overcome the positioning of dowels at inconvenient places, such as the sides of bosses, etc. It is also essential that all drilled holes should be a tight fit for dowels. When any doubt arises whether the dowel and drill are correct size it is far better to drill a hole in a spare piece of wood and try the dowel in before proceeding with the pattern. For if they are a loose fit in their holes, dowel pins are useless.

Use in Coreboxes

Another use for wooden dowels is for securing the bottoms of frame coreboxes, which, through continual rapping may become loose. This applies especially when there are no internal pieces large enough to help to strengthen the structure. Fig. 4 shows a corebox with two dowels fixed through the bottom into the sides. They can, of course, also be placed in the ends if considered necessary. Another way in which dowels help the pattern-maker is by way of giving extra security to long coreprints, which cannot, owing to their position or shape, have a spigot or extension for this purpose. These prints may be firmly held by the inclusion of one or two good dowels passing through their depth and continuing well into the pattern.

Wooden dowels can also play a useful part in strengthening pieces of timber, on which, because of cut-out shapes, sections are left which may be broken easily with continual usage in the moulding or coreshops. Fig. 5 illustrates a loose top-piece of a corebox, that had a number of weak sections between the holes. These were strengthened by inserting and glueing wooden dowels across the full width in the centre of each part. On occasions like this it is essential that any necessary shapes should be first marked out, so that the exact position for dowels can be found. It is then imperative that the dowels be permanently fixed into position before any shapes are cut out. Otherwise the forcing of a wooden dowel through a weak section may cause it to break or crack.

THE COUNCIL of the Institute of Metals has awarded their Platinum Medal for 1953 to Professor Georg Masing, of the Institut für Allgemeine Metallkunde, Universitat Göttingen, in recognition of his outstanding contributions in the field of metallography.

New Catalogues

Automatic X-ray Film Processing. A pamphlet received from Nucleonic and Radiological Development, Limited, 22, Marshgate Lane, London, E.15, describes in great detail and clearly illustrates an apparatus for processing X-ray films under fully automatic control. The reviewer commends the clarity with which this pamphlet has been presented. Foundries having an X-ray department should certainly write to Marshgate Lane for a copy.

Refractories. An eight-page leaflet received from Refractory Mouldings & Castings, Limited, 10, Market Place, Kegworth, near Derby, describes a rapid service which is available for the production of non-standardized refractory shapes for exceptional duty, including very high temperature duty. Because the shapes are bespoke, the firm does not make the ordinary run of squares and bricks, but concentrates on such jobs as the provision of silimanite crucibles for special jobs. This catalogue is available for our readers on application to the advertising manager at Kegworth.

Industrial Matting. There are certain kinds of castings which are so delicate that one has to accept the explanation that "it just dropped out of my hand." A remedy is suggested by a leaflet received from Nuway Manufacturing Company, Limited, Coalport, Shropshire, which describes a matting which has every appearance of being made from a rubber and canvas base. Though unsuited for places where hot metal is likely to be splashed, one could easily imagine others where their installation would be appreciated. In these matters cost is the final arbiter, and this is a matter beyond our purview.

Castings. Kent Alloys, Limited, of Temple Manor Works, Rochester, Kent, have just issued a 12-page, nicely-illustrated catalogue setting out the range of alloys which they currently manufacture. This range is very wide and embraces cast iron, light alloys and a few copper-base alloys. A mistake has been made, especially so far as cast iron is concerned, in omitting to give the weight range. Moreover, nowadays one should stress whether or not repetition work or purely jobbing work is undertaken, although it is obvious to the reviewer that it is the former in which they specialize. Many useful data are included, and the ability of the firm to give a proper technical service is rightly emphasized. The booklet is dignified and worthy of emulation by other foundry concerns. In preparing catalogues such as this, the attraction of new business is the main objective sought, yet if unfruitful enquiries can be reduced so much the better.

Mould Conveyors Knock-out Equipment. An eight-page, well-illustrated pamphlet, received from Foundry Equipment, Limited, Linslade Works, Leighton Buzzard, Bedfordshire, does not confine itself to the subject matter of the title which is quoted. For instance, there is included one very interesting page of layouts for the mechanized production of castings. On the page devoted to knock-out equipment, several types are listed, and one is illustrated together with a powered roller conveyor for the return of the box-part. As indicated, this subject is controversial. Whilst three systems for the return of the "boxes" receive comment, the reviewer is not enamoured of any of them. Although the one illustrated is probably as good as any, the lifting of the box-parts to the upper conveyor must involve many ft.-lb. of work per hour from the operators. The reviewer believes this pamphlet is of real interest to readers, and suggests they write to Leighton Buzzard for a copy.

Australian Experiments with Nodular Cast Iron

In a Paper to the Institute of Australian Foundrymen, Mr. R. B. Whitelaw included descriptions of his personal experimental work in this field. He records that little success was achieved using cupola-melted iron, although partially-nodular structures were produced by adding excess magnesium to desulphurize, before magnesium actually dissolved in the iron. Better results were obtained with electric-melted iron, in which the sulphur of the base metal was kept below 0.06 per cent.

Crushed magnesium/nickel and magnesium/copper alloys below ¼ in. size gave the best results, and placing the alloy in the bottom of the ladle just before filling was the most satisfactory method of making the addition. Mischmetal was very soluble and could be added either to the bottom of the ladle or stirred in. In all cases 75 per cent. grade ferro-silicon was used for inoculation, additions being in the ratio of one pound per 100 pounds of metal.

Experimental Cast No. 1

Using cupola-melted metal as a base iron, 3 lb. of crushed magnesium/copper was added to a 2½-cwt. ladle. After treatment the metal was inoculated with 2½ lb. of ferro-silicon. The composition before and after treatment was as follows:—

Condition.	Chemical composition, per cent.						
	T.C.	Si.	Mn.	P.	S.	Cu.	Mg.
Before treatment	3.42	2.22	0.59	0.23	0.09	nil	nil
After treatment ..	3.40	2.71	0.60	0.20	0.03	0.68	0.34

The treated metal was cast into 3½-in. Chevrolet pistons and samples were taken from the heads of these for physical testing and micro-examination, giving tensile strength, 27.0 tons per sq. in.; elongation, nil; hardness, 218 V.P.H. The microstructure contained a few graphite nodules, but was essentially fine, type A graphite flakes in a pearlitic matrix. The chilling tendency of this iron was greater than that of the untreated iron, despite the higher silicon content and increased inoculation. The shrinkage was also greater.

Experimental Cast No. 2

Electric-melted iron was used as a base iron for the second experiment: 1¼ lb. of crushed magnesium/nickel alloy was added to the bottom of a 100-lb., teapot-spout ladle, and metal was poured on top, while the addition was stirred with a skimmer. As soon as the magnesium reaction had ceased, 14 oz. of ferro-silicon was stirred in. A stack of valve inserts of ¼-in. square section was cast from this ladle. These were white in fracture, but the central runner exhibited was grey, and on micro-examination was found to be nodular.

The composition per cent. before and after treatment in this case was:—

Condition.	Chemical composition, per cent.						
	T.C.	Si.	Mn.	P.	S.	Cu.	Mg.
Base iron.. ..	3.47	2.96	0.61	0.17	0.06	0.12	nil
Magnesium-treated iron ..	—	3.34	—	—	0.004	0.89	0.23

The physical properties were:—Tensile strength, 37.9 tons per sq. in.; elongation, nil; and hardness, 293 V.P.H. and the micro-structure of the runner consisted of nodular graphite in a pearlitic matrix.

The most interesting observation from this experiment was the strong chilling tendency of small percentages of magnesium dissolved in the iron. Normally the inserts are cast in a grey alloy iron containing 3.30 per cent. total carbon, 2.40 per cent. silicon, and 1.0 per cent. molybdenum.

Experimental Cast No. 3

Using electric-melted iron, a sleeve 2¼ in. i.d. and 4¼ in. o.d. was cast from 100 lb. of metal treated with 1½ lb. mischmetal. The mischmetal was cut into ½-in. cubes and added to the bottom of the ladle just before filling, the alloy being particularly soluble, and the metal was inoculated with 1 lb. of ferro-silicon.

Condition.	Chemical composition, per cent.				
	T.C.	Si.	Mn.	P.	S.
Base iron	3.48	2.96	0.61	0.17	0.06
Cerium-treated iron.	—	3.40	—	—	0.006

Microspecimens and tensile test-pieces were cut from the casting and the microstructure consisted of "quasi-graphite," with a matrix of ferrite and pearlite. The physical properties were:—Tensile strength, 27.2 tons per sq. in.; elongation, 3.0 per cent., and hardness, 205 V.P.H.

The sleeve was turned and bored and piston rings were parted off. It was difficult to obtain a good surface finish, due to the tendency for the metal to drag. The piston rings were tested for load by closing the free gap, and were found to be far superior to normal flake-graphite irons. The elastic modulus calculated from the approximately square section of these rings was found to be 22×10^6 lb. as compared with 15×10^6 lb. for a good pearlitic iron with flake graphite.

Interim Conclusions

The conclusion from these and other experimental casts was that the phenomenal strengths claimed for this material were readily obtainable, provided a base iron of the right composition was available.

Australian Experiments with Nodular Cast Iron

No doubt with improvement in technique and with good chemical control, a foundry possessing an electric furnace, and in a position to use selected raw materials, could consistently produce high-tensile castings with only slightly higher casting wastage than for grey iron.

A cupola tends to make the process itself more expensive and is not nearly as certain to produce consistently good results. Even with high pig-iron charges and selected scrap to lower the sulphur content, it is difficult to produce an iron of less than 0.08 per cent. sulphur with Australian coke, which means that 0.05 per cent. sulphur must be removed before cerium or magnesium will commence to enter into solution and affect the graphite form. Lowering of the sulphur may be brought about by ladle treatment with soda ash, or by using excess magnesium or cerium alloy. There is no doubt that the addition alloys will desulphurize, as seen from the extremely low sulphurs obtained in experiments Nos. 2 and 3. Although it is possible to de-sulphurize cupola-melted irons, the results obtained are not consistent. However, from the literature, it is gathered that a large percentage of the nodular iron being produced overseas is melted in a cupola.

The flare and violent reaction produced by magnesium is a little frightening at first, but could not be called dangerous. It is soon treated with the same contempt shown by foundrymen to molten metal, but it is difficult to see the metal level in the ladle until the reaction dies down, owing to this vivid glare.

Casting and Moulding Problems

Nodular iron appears to have good castability and compares favourably with grey iron at the same temperature. Thin sections can be cast with good surface finish, but are prone to chilling. An oxide skin is formed on top of the metal, similar to that obtained with chromium or molybdenum alloy irons. Shrinkage characteristics are intermediate between those of grey iron and steel, and greater allowances must be made on patterns for castings of this material. Considerations must also be given to feeding, gating and risering. The fracture of nodular iron is more metallic than that of grey iron, and the material gives a definite ring when struck.

Scrap treated with magnesium and cerium can be mixed with grey-iron scrap without fear of contamination, as the special elements oxidize during re-melting. However, consideration must be given to the carrier alloys—nickel, copper, etc.

DEVELOPMENTS IN FOUNDRY PRACTICE

A Paper presented by Dr. E. R. A. Pohl, carrying the above title also dealt with nodular cast iron and in connection with foundry procedure listed the following points as being worthy of consideration.

(1) The slag produced is more fluid than usual and particular attention must be paid to the question of cleanliness. To avoid the introduction of slag-traps into the running system, the use of "teapot-spout" ladles is recommended.

(2) Despite the frequent "dull" and sluggish appearance, the fluidity of the liquid metal is good and no difficulty is experienced in running castings.

(3) Since magnesium is a carbide-forming element, chilling of thin sections occurs more readily than with ordinary grey irons. The tendency for thin sections to chill on the edges can be overcome by a simple annealing treatment. Sections of ½ in. thick or over can, however, be cast grey with perfect regularity.

(4) The shrinkage of nodular iron is different from that of flake-graphite iron and similar to that of steel. It tends to pipe deeply and, in consequence, more care has to be taken in feeding. The feeding head should always be placed over the heaviest section of the casting, and since the hottest metal should be retained in the feeding head, it is sometimes advisable to run the casting through the feeding head. Side feeding through whirl-gate feeders often gives satisfactory results.

Where the design of the casting is such that the large amount of heat necessary to produce the correct thermal gradients cannot be supplied to the feeder, the application of the Connor-block runner is worth special consideration. Although these heads are often rather heavy, as in curved check castings, this method of running has been found most successful in producing complete freedom from shrinkage and scabbing from the concave bottom face.

Pressure Tightness

Owing to the shape and distribution of the graphite in nodular iron, this material is denser and less porous than flake-graphite iron and in consequence is very suitable for castings required to withstand high pressures. A pressure header for a pump, for example, withstood 5,000 lb. per sq. in. The design was such that the casting could not be made in steel and the pressure was too high for normal grey iron. Other similar examples are bodies for hydraulic jacks, cylinders, pistons and pressure pipes for transmitting fluids and gases.

Changes in Section

Nodular cast iron is relatively insensitive to changes in section thickness. In the as-cast condition, strength and hardness decrease as the section is increased from one to six inches, but this drop is not as great as would be experienced with flake-graphite grey iron. In the annealed condition, the strength is maintained in the heavy sections, while being uniform throughout the whole cross section. Elongation values are, however, reduced somewhat depending upon the success of the annealing treatment towards inducing a completely ferritic structure in the centre of the heavier sections.

Ratio of Compression to Tensile Strength.—The ultimate compression strength of flake-graphite iron is very high in proportion to its tensile strength, the ratio normally being of the order of 3½/4 to 1. In nodular iron, this high ratio is not maintained. It is lower than for grey iron, though higher than for steel.

Damping Capacity.—In machine design, the ability in a material to damp out vibrations which

might otherwise build up stresses to dangerous levels or result in undue noisiness has always been desirable. Nodular iron, while not as good in this respect as the low-strength grey iron, is superior to steel.

Modulus of Elasticity.—Nodular cast iron has a modulus of elasticity in the region of 10,000 tons per sq. in. and in consequence of its high stiffness combined with high tensile strength, is used for the cylinder-heads of heavy-duty Diesel engines. The same properties render it extremely suitable for the rolls of printing presses, paper, textile and similar machinery. The possibility of reducing wall thickness to achieve a more rapid heat-transfer renders it particularly valuable for the construction of steam-heated drying rolls.

Wear Resistance.—A higher resistance to wear in shafts, etc., both in the lubricated and unlubricated condition, combined with high tensile strength, will interest many engineers. As an example, test runs by a piston-ring manufacturer demonstrated that the wear resistance of spheroidal-graphite cast iron, unlubricated, is comparable with the best piston-ring grades of open-grained flake-graphite cast iron. In other cases, test runs have revealed excellent wearing qualities when lubricated. Annealed nodular-iron bearings in the roll-out table of a sheet mill were found to possess a service life as much as four times that of the original bronze bearings while the initial cost was only one-third.

Good bearing properties, combined with strength and toughness, make nodular iron useful in other conditions involving wear, such as for gears, cylinder liners, Diesel-engine pistons and many agricultural implements. Further to improve the wear and abrasion resistance, it is possible to flame-harden nodular iron to a hardness of up to 600 Brinell. Self-lubricating properties, together with high strength and ductility render nodular iron very useful for dies such as those for pipe-bending, motor-car bumpers, etc. It can be used in the as-cast or hardened condition.

Fatigue Strength.—The fatigue resistance of nodular cast iron, both in the notched and un-notched condition, is equivalent to that of the ordinary grades of steel. This property, added to its good torsional strength, stiffness and wear resistance, makes it suitable for crank-shafts, cam-shafts, generator shafts, levers, etc.

Combination of Hardness and Toughness.—In nodular-iron ploughshares, advantage is taken of the ability to combine a chilled carbidic, abrasion-resistant area with a tough, ductile material. Over 200,000 ploughshares have been produced. Although guaranteed unconditionally against breakage, returns have been negligible. In use they have exhibited wear resistance superior to that of steel and shock resistance superior to that of grey iron. This combination of properties has also found application in various earth-moving equipment, for chute linings and in mining equipment.

Growth Resistance.—Nodular iron shows an excellent resistance to growth. Whereas flake-graphite offers an easy path to the penetration of oxidizing gases, the nodular or spheroidal form is most obstructive. Tests carried out by Gagnebin and Pilling show that after an initial small growth, nodular cast iron becomes relatively stable. Resistance to growth when exposed to elevated temperatures opens up a wide field of heat-resisting applications for nodular iron, such as furnace doors, grate bars, supports for soaking-pit covers and also for turbine housings.

Machinability. — In the as-cast condition, spheroidal-graphite cast iron machines as freely as flake-graphite iron of the same hardness, but produces a smoother surface. It can be satisfactorily machined at cutting speed of 1,000 ft. per min. without undue wear. It normally is cut with a broken chip, but when annealed produces a continuous chip similar to steel. Compared with a good quality grey iron, annealed ductile iron will enable output to be doubled or even trebled from the same machine. An important advantage is that machinability can be predicted by examination of the microstructure. Machinability improves as ductility rises, as the amount of free ferrite increases, or as the Brinell hardness decreases. Thus, annealed castings with a ferritic structure, while still retaining high mechanical strength (31 to 25 tons per sq. in.) offer an engineering material of good quality which can be handled at high production rates.

British Standards Institution

Green Protective Spectacles and Screens for Steelworks Operatives. B.S. 1729 : 1952

Much wisdom has been shown in standardizing a material destined with the passage of time to replace the traditional cobalt blue, because once a furnaceman starts using a particular type of glass, it is very difficult for him to change over. It is thus recommended that all entrants to the furnace department should start off with the new type of spectacles, as these give the maximum protection to the eyes at present available. The title of the specification is too restrictive, as foundries also install melting furnaces. It should be changed to "Green Protective Spectacles and Screens for Steel-melting Furnace Operatives."

Methods of Testing Refractory Materials

A new standard (B.S. 1902:1952), issued by the British Standards Institution, describes methods of testing refractory materials, and is based on the work of the British Ceramic Research Association. It relates more particularly to fireclay and silica refractories, and the following standard tests are described:—Chemical analysis, including the determination of hygroscopic water, loss on ignition, determination of silica, ferric oxide, titania, lime and magnesia, and determination of alkalis; physical tests, including the determination of porosity and density, true specific gravity, permeability to air, refractoriness, refractoriness-under-load, permanent linear change on reheating, cold crushing strength, reversible thermal expansion, and resistance to the disintegrating effect of carbon monoxide. A tentative test for resistance to thermal shock is given as an appendix. Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1, price 7s. 6d.

Parliamentary

Conditions in Iron Foundries

When MISS MARGARET HERBISON (Lanark, North, Lab.) moved the second reading of the Foundry Workers (Health and Safety) Bill, referred to editorially last week, she said that, in 1951, foundries employed more than 145,000 workers. Until 1950, the accident rate was going down gradually, but in 1951 the accident rate among foundry workers slightly increased. In 1951 there were 11,055 accidents and 22 were fatal. The accident rate for industry as a whole in 1950 was 25 per 1,000, but among foundry workers it was 75 per 1,000, and in 1951 it was 76 per 1,000.

" Surely these figures show how very hazardous is the nature of this industry. If we take the accident rate among foundry workers we see that on the average it is three times greater than that for all workers of this country. These figures cry out for everything humanly possible to be done to lower the accident rate and to make the job of the foundry workers less hazardous," Miss Herbison added.

MR. HAROLD WATKINSON, Parliamentary Secretary to the Ministry of Labour, said that the Government wholeheartedly supported the objects of the Bill. The Minister would be pleased to have a demand from the trade unions for further consultations on how they could implement as quickly as possible the recommendations of the Garrett Committee's report. If those demands were made he would undertake to remit any points in the Bill to the joint standing committee, and, if the committee said it was desirable for these things to be carried out quickly, the Government would make the necessary recommendations and take steps to see that they were enacted as quickly as possible. He thought this would be a quicker way of achieving the objects desired than by sending the Bill to committee.

Miss Herbison said that the sponsors of the Bill could not possibly allow it to drop at this stage. They had in it all the recommendations of the Garrett Committee.

The Bill was read a second time.

£151,000,000 Steel Developments

The Minister of Supply, MR. DUNCAN SANDYS, told MR. G. R. STRAUSS in a written reply that schemes proposed by 46 companies, at an estimated cost of about £151,000,000, had been approved by the Iron and Steel Corporation of Great Britain.

These schemes related mainly to the construction of coke ovens, blast furnaces, steelmaking plant, and steel rolling and finishing plant, together with associated ancillary plant and services.

IN A WRITTEN ANSWER to Mr. Robson-Brown, the Minister of Supply, Mr. Duncan Sandys, stated that the total number of iron and steel founders in Great Britain and Northern Ireland was approximately 2,000. About one-third of the founders used 50 per cent. or more of their output of castings, while the number of foundries employing less than 50 employees on direct foundry operations was about 1,200.

GLOBE AGENCIES, LIMITED, 46, Duke Street, Kingston, Jamaica, wishes to secure agency representation of U.K. manufacturers of oil burners, oil and solid-fuel stoves, galvanized steel pipes, nails, mesh wire, etc. Interested makers should write to the firm at the above address, at the same time notifying the Board of Trade, Commercial Relations and Exports Department, Horse Guards Avenue, London, S.W.1 (reference, CRE/40288/52), of any action taken.

United Kingdom Trade in November

United Kingdom exports in November were valued provisionally at £207,200,000. Although this was lower than the recorded value of exports in October, at £218,800,000, the daily rate of export in November was 2 per cent. higher than in October, as there were only 25 working days in November as against 27 in October. Taking the two months together, the monthly average for October/November was £213,000,000, compared with a monthly average of £191,300,000 in the third quarter, an increase of 11 per cent., but still below the average of £224,400,000 for the first half year, and of £227,900,000 for the last quarter of 1951.

Imports into the U.K. were £261,800,000, compared with an average of £262,600,000 in the third quarter, and £266,600,000 in October. The total for the 11 months January/November was £3,218,000,000, compared with £3,603,000,000 in the corresponding period of last year. With re-exports at £8,900,000, the excess of imports (c.i.f.) over exports and re-exports (f.o.b.) was £45,700,000, compared with £35,700,000 in October and £61,100,000 per month in the third quarter. The average excess per month since the beginning of the year is £66,900,000.

There was a contraction in U.K. exports to North America in November (a short working month), the provisional total being £24,400,000, compared with £28,600,000 in October, but the November total was still £1,200,000 more than the third quarter average. For the year to date exports to North America averaged £22,600,000 a month, compared with £23,400,000 in the corresponding period of last year.

Exports to both Canada and the United States shared in the November reduction. Shipments to Canada were £12,500,000, compared with £14,200,000 in October and £11,800,000 a month in the third quarter, while last year they were £10,300,000 in October and £11,300,000 in November.

Shipments to the United States were down to £11,800,000, compared with £14,400,000 in October and £11,400,000 a month in the third quarter, while last year in October they were £11,800,000 and £10,100,000 in November.

Origin of a Bath

Interesting reminiscences were recalled on December 11 of William Flavel, one of the founders of the well-known Leamington firm of iron founders which celebrated its 175th anniversary on that date. Flavel's chief invention was, of course, the " Patent Kitchener," the old form of cooking range which followed the open fire and spit. But among his more dramatic achievements in 1803 was the English version of the Russian bath and the tale goes that a Russian nobleman, Major-General Sabloukoff, threatened to cut short his stay (and that of his large retinue) in Leamington, unless a vapour bath of the kind he was used to was forthcoming. Leamington turned to Flavel who produced the necessary bath, and so successful was it, that he improved on his original design and made others for other visitors to the famous spa.

AN ORDER has been placed with the Neptune yard, Walker-on-Tyne (Northumberland), of Swan, Hunter & Wigham Richardson, Limited, for a motor tanker of 18,000 tons dw. for the Tramp Chartering Corporation of Panama.

Commonwealth and World Trade

Conference Plans for Big Expansion

A wide range of agreement over the whole range of economic policy was achieved by the Commonwealth Economic Conference which recently ended in London. It was agreed to seek the co-operation of other countries in a plan for expanding world production and trade, the object being to create an effective multilateral trade and payments system covering the widest possible area. Disinflationary policies designed to maintain external payments in balance individually and collectively will be pursued by the Commonwealth Governments. These decisions have increased significance to the foundry industry in view of the Chancellor's exhortations for vastly-increased exports in 1953.

The main object of future investment policy will be to advance development projects which will help the sterling area's balance with the rest of the world, either through import saving or through an increase in exports. The increased export of capital to the rest of the sterling area for this purpose will be undertaken by Britain. A substantial overall balance of payments surplus will be maintained by Britain to this end, and the volume of savings in this country will be kept at a high level.

The convertibility of sterling, stated a communique issued by the conference, could only be achieved by the continuing success of action by the sterling Commonwealth countries themselves, the prospect that trading nations would adopt trade policies which were conducive to the expansion of world trade, and the availability of adequate financial support, through the International Monetary Fund or otherwise. It was proposed to seek acceptance of this plan by the Government of the United States and of European countries, whose co-operation was essential, and to work as far as possible through existing international institutions dealing with finance and trade.

I.M.F. Aid to be Sought

In addition to the approach to the United States, which would cover the whole problem of fostering the expansion of world trade, as well as the specific convertibility issue, it was proposed that the Commonwealth should ask the International Monetary Fund for support for its programme. In order to make any appreciable and rapid progress towards its main objectives, the sterling area must command larger reserves of gold and dollars than at present, and the conference reached agreement on policies which, it was hoped, would provide a further addition to these reserves during the coming year. The co-operation of the I.M.F. would be sought in this matter.

Investment funds from outside the sterling area, it was announced, would be attracted by the United Kingdom Government by the liberalization of the present regulations governing the transfer of capital across the exchanges. Britain had also decided to make sterling available to the International Bank for loans for projects which were designed to improve the sterling area's balance of payments. Before making any additional finance available for Commonwealth development the U.K. would make sure that the country itself was devoting an adequate part of its resources to the kind of investment which would improve the balance of payments of the sterling area as a whole. It would also insist that the country receiving the capital was making a sufficient contribution to the scheme from its own resources.

Efforts were to be made to ease the difficulties caused to Britain and other sterling exporters by trading restrictions as soon as the financial position of the countries concerned made this possible.

Recognizing that there was no one universal remedy for the problem of instability of primary commodities, the Commonwealth Governments were ready to co-operate in considering international schemes designed to ensure stability of demand and prices at an economic level. The need for an agreed procedure for calling together the Governments concerned to consider emergency action in the event of rapidly developing conditions of surplus or shortage of commodities entering into international trade was also expressed.

Empire Finance Company

As an outcome of discussions which have been taking place recently between various commercial, industrial, and other concerns it has been proposed to form a finance company to develop Empire resources and other projects throughout the Commonwealth. An organizing group has been formed to carry out the plan with Sir Edward Peacock, a managing director of Baring Bros. & Company, Limited, and a director of the Canadian Pacific Railway Company, as chairman, and including Sir George Erskine, a managing director of Morgan Grenfell & Company, Limited, and a director of other companies, Sir John Keeling, who is on the boards of a number of financial and industrial concerns, Sir Clive Baillieu, chairman of the Dunlop Rubber Company, Limited, and a director of a number of other companies, Sir Frederick Godber, chairman of Shell Petroleum Company, Limited, and a director of other oil companies, Sir Geoffrey Heyworth, chairman of Unilever, Limited, and a part-time member of the National Coal Board, Mr. H. C. B. Mynors, an executive director of the Bank of England, and Mr. I. A. R. Stedeford, chairman of Tube Investments, Limited, and South Wales Aluminium Company, Limited.

The company, which will be formed with the support of the Bank of England, will assist in providing financial assistance for projects within the Commonwealth, and also British industrial, commercial, and financial experience in the examination and furtherance of such products, and will co-operate with other organizations in the U.K. and overseas working in the same field, with oversea capital markets, and with the International Bank for Reconstruction and Development.

THE TELEPHONE NUMBER of Foundry Services, Limited, Birmingham, has been changed to East 1911, and the number of lines serving the company has been increased to 10.

THE FIRST ANNUAL DINNER of the Six Hundred "25" Club was held at the De Vere Hotel in London. In 1934, George Cohen Sons & Company, Limited, celebrated their centenary year, and watches were presented to all employees who had been with the company for 25 yrs. or more. In that year, 25 employees qualified for the award. The practice was continued and early this year the number of employees with 25 yrs. of service or more totalled 220.

Personal

MR. R. A. HETZIG has now left Powder Metallurgy, Limited, London, W.C.1. He was editor of the "Metal Powder Report" issued by that company.

MR. B. R. FRASER has been appointed assistant refinery manager of the oil refinery now nearing completion at Coryton (Essex) of the Vacuum Oil Company, Limited.

MR. P. E. WARDEN, manager of the drawing office of the Rugby and Coventry works of the British Thomson-Houston Company, Limited, has retired after 50 years' service, and is succeeded by his deputy, MR. J. R. TOLE.

MR. A. K. MCCALL, managing director of Churchill-Redman, Limited, machine-tool makers, of Halifax, was presented with a silver cigarette box at the annual staff dinner in Halifax last weekend, to mark the completion of 25 years' service with the company.

AT A MEETING of the Board of Smith & Wellstood, Limited, Mr. R. R. Fyfe Smith and Mr. R. F. Maxwell were appointed joint managing directors. Mr. John C. Leith has been made a director as from January 1, 1953, and will continue in his present office as works manager.

MR. BERNARD G. HOUSEMAN, who has been elected chairman of the Northern branch of the National Union of Manufacturers, is managing director of Houseman & Thompson, Limited, marine and land boiler water treatment specialists, of Newcastle-upon-Tyne. He is a member of the North-East Coast Institution of Engineers and Shipbuilders.

COUNCILLOR F. N. LLOYD is chairman of the newly-formed panel which has been set up by the Wolverhampton District Advisory Committee of the Regional Board for Industry, to explore the scope for economy in the use of fuel and power in industry. Eighty-five firms in the area have been invited to take part in discussions, which the panel, officially called the Fuel Efficiency Panel, will organize. The panel can draw on the technical services of Government departments but it is felt that the real solution of the problem may arise from the exchange of ideas between firms.

Board Changes

DOWTY EQUIPMENT, LIMITED—Mr. F. J. A. Mangeot has been elected a director.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED—Mr. David John Robarts has been appointed a director.

READS, LIMITED—Mr. P. K. W. Greggains, managing director since 1942, has been appointed chairman.

G. D. PETERS & COMPANY, LIMITED—Mr. M. Whitelow has been elected a director; Mr. J. F. Dawson and Mr. C. B. Broome have retired from the board.

R. H. WINDSOR, LIMITED—Mr. Arthur George Dennis has been appointed chairman. Mr. Henry Vincent Yorke and Mr. C. Norman Baker have been appointed to the board.

CAMPBELL & ISHERWOOD, LIMITED—Mr. H. Campbell, vice-chairman and general manager, has been elected chairman in succession to the late Mr. G. F. D. Campbell.

R. A. LISTER & COMPANY, LIMITED—Mr. M. I. Prichard, Mr. F. E. Blackstone, and Mr. C. D. MacQuaide have been invited to join the board as assistant directors.

RICHARDSONS WESTGARTH & COMPANY, LIMITED—Mr. Maxwell Woosnam has been elected vice-chairman, and Mr. A. Kinsman and Mr. R. M. Atkinson have been appointed directors.

I.V.E. President Honoured

The council of the Institute of Fuel has unanimously agreed to award the Melchett Medal for 1953 to Dr. Harold Hartley in recognition of his high scientific attainments in the development of domestic-heating appliances, coupled with the administrative skill with which he has guided a great industrial organization devoted to the practical efficient use of fuel. Dr. Hartley is chairman of Radiation, Limited, and president of the Institute of Vitreous Enamellers.

A native of the Isle of Man, he was educated there, at Manchester Grammar School, and at Manchester University. He graduated head of his year in chemistry in 1907, and was elected to a Gartside Scholarship of Industry and Commerce, and after a year spent in the School of Economics at Manchester he visited Norway and Canada to study the production of power for electrochemical industries. Returning to England, he worked for three years as a gas research fellow at Leeds University under the late Prof. W. A. Bone.

In 1912 Dr. Hartley was appointed chief chemist to the Richmonds Gas Stove & Meter Company, where he built up a technical and research section and continued the work on the measurement of the radiant efficiency of gas fires which had been started at Leeds in 1908. In 1919 he was awarded the degree of D.Sc. of Manchester University, and the same year he was appointed head of the research department of Radiation, Limited, on the formation of that company. At the new central research laboratories in London he directed many important investigations into the design of gas-fired appliances. He was elected to the board of Radiation, Limited, as technical director in 1938, becoming deputy chairman in 1948, and succeeding to the chairmanship in 1949.

Besides serving as president of the Institution of Gas Engineers (1947-48), Dr. Hartley has been chairman of the council of the British Cast Iron Research Association and, in 1945-47, president of that body. He was awarded the C.B.E. in the 1952 New Year Honours and has been a member of the Institute of Fuel since 1944 and was elected a Fellow in 1948.

Obituary

MR. CHARLES RAYMOND HOWARD, a partner in G. Howard & Sons, engineers and ironfounders, of Louth (Lincs), was killed in a motor accident in London recently. He was 44.

MR. JAMES WHIMSTER, who was a partner of W. S. Whimster & Son, iron and steel stockholders, of Montrose (Angus), until he retired in 1947, died recently.

MR. JOHN ALLEN HOWE, a past-president of the Institution of Mining and Metallurgy, and a former assistant director, Geological Survey, has died at the age of 83.

PRODUCTION of aero jet engines at the new Rolls-Royce factories at East Kilbride will not be affected by the Government's change in aircraft policy. This was recently stated by Sir Patrick Dollan, chairman of the new town Development Corporation, in a progress report on the factories. He points out that the Rolls-Royce factories will be engaged mainly on the production of engines and spares for Comet and other civil aircraft and will also handle export orders.

News in Brief

SUMMER TIME will begin on April 19 next year and end on October 4.

THE CENTENARY ISSUE of the "Journal of the Royal Society of Arts" contains interesting extracts from some of the hundred volumes.

APPROVAL HAS BEEN GIVEN to plans for the erection of machine sheds at the West Shipyard, Sunderland, of Wm. Pickersgill & Sons, Limited.

DURING NOVEMBER, production of steel ingots and castings in the Sheffield area, totalled 48,300 tons, compared with 44,200 tons in November last year.

A REPRESENTATIVE of David Brown (Tractors), Limited, Meltham, has stated that some 200 tractors would be exported to make up an order worth £100,000 from Denmark.

AWARDS of from £1 to £40 have been made to twelve employees at the Ickles Works, Sheffield, of United Steel Companies, for useful suggestions made during the year.

AFTER BEING ESTABLISHED for nearly 30 years under the name of the Finlay Conveyor Company, Limited, Newport (Mon), it has been decided to re-name the company Finlay Engineering, Limited, with effect from January 1.

SOLUS-SCHALL, LIMITED, have opened a new non-destructive testing station at Matlock, Derbyshire. It is equipped with X-ray, gamma-ray, magnetic and single-probe ultrasonic apparatus and is within easy reach of most of the large manufacturing centres of the Midlands.

A TOUR of Stanton Ironworks has been made by a party of Nottingham University students from British Guiana, Jugoslavia, Jordan, America, and other parts of the world. The visit was arranged in conjunction with the Ilkeston Rotary Club, and was made under the leadership of Mr. F. Davison, assistant training officer.

THE DIRECTORS of George Cohen Sons & Company, Limited, have announced that the consent of the Capital Issues Committee has been received to the issue of 3,600,000 shares of 5s. each, as capitalization of reserves. The shares will be issued as fully paid up, early in the New Year, in the proportion of three shares for every two ordinary stock units held by stockholders.

MR. A. TAYLOR, Tipton's Borough librarian, continues to find for his museum exhibits of interest to local foundrymen. His latest find is a picture of a cast-iron lock-house, one of the few in the country, which used to stand on the canal side of Tipton Green. It shows a single-storey building made of cast-iron plates bolted together, and records show that the house was built early in the 19th century.

THE FIRST DIVISION of the Court of Session on December 12 declined to postpone granting an order of interim interdict against James F. Low & Company, Limited, Monifieth Foundry, Monifieth, in the action in which they were earlier found to have infringed patent rights relating to certain jute-spinning machinery. The company asked for the delay in order that they might consider whether to appeal to the House of Lords.

MR. EDWARD PLAYER, managing director of Birmid Industries Limited, will take the chair on January 21 when, at the annual presentation, certificates of the successful completion of their course will be handed to the 20 apprentices who qualify this year. Certificates will be presented by Mr. Harry Garratt, who, until last August, was principal of the Chance Technical College, Smethwick, and who did so much to launch the Birmid apprenticeship scheme from the technical college side.

THE EDINBURGH WORKS of the well-known engineering firm of Graham-Enock & Company, Limited, at Marine Gardens, are to close down at the end of December. The directors of the firm have found this necessary because of the lack of orders from home and abroad for dairy machinery and the heavy import tariffs placed on their machinery by Commonwealth and other governments. About 100 employees, including the clerical staff, will be thrown out of work; the firm, however, will continue to operate their London factory at Stamford Hill.

HEAD, WRIGHTSON & COMPANY, LIMITED, the Thornaby-on-Tees engineering concern, has several important contracts in hand, including the fabrication and erection of a second blast-furnace plant for John Summers & Son, Limited, Shotton; the erection of ore handling and beneficiation plant for the Appleby Frodingham Steel Company, branch of the United Steel Companies, Limited; the construction of nine pairs of dock gates for the Port of London and other port authorities; and the construction of more than 2,000 steel wagons for British Railways.

VICKERS-ARMSTRONGS, LIMITED, announces that they have acquired the sole right to manufacture and sell the equipment previously supplied by Hyland, Limited, Wakefield. This includes an extensive range of hand and power operated hydraulic steering gears for ships and deck machinery, such as cargo winches, capstans, and windlasses. In February, Vickers-Armstrongs announced that they had purchased the works and plant of Hyland, Limited, at Wakefield. As it is now to be known, the Wakefield works of Vickers-Armstrongs, Limited, will continue to be used for the manufacture of the complete range of Hyland products, and, in addition, for the expansion of Vickers variable speed gear production.

A METHOD for determination of oxygen in metals using isotopes was described by A. D. Kirskenbaum and A. V. Grosse in a paper submitted at the 34th National Metal Congress organized by the American Society for Metals in conjunction with other important technical bodies and held in Philadelphia in October. The authors recall that the quantitative determination of oxygen in metals and metal oxides has long been a difficult task. The isotopic method, they say, requires apparatus as elaborate as most, a supply of oxygen-18, and the availability of a modern isotopic mass spectrometer. It does not, however, require quantitative separation or recovery of the oxygen, and takes only about 2 hrs.

Correspondence *(Continued)*

ambit of the Board's supervision, it would inevitably follow that the Board would have no interest in or responsibility for the raw-material supplies of the iron foundries. The objective of H.M. Government is to set up a strong independent statutory Board fully representative of the whole industry, and thereby get the industry out of politics. Every industrialist should support the Government wholeheartedly in this essential objective.—Yours, etc.,

F. SCOPES,
President, the Joint Iron Council.

Crusader House,
14, Pall Mall,
London, S.W.1.
December 19, 1952.

Raw Material Markets

Iron and Steel

Most of the foundries continue to feel the effects of the decline in trade, and at present there is little to justify the hope of an early revival in the demand for castings. Compared with the position at the opening of the year, when practically all establishments had sufficient business on hand to engage their full productive capacity, the only drawback being the shortage of raw materials, the recession in trade of recent months is most pronounced. This has resulted in many establishments being on short time and has led in some instances to the suspension of labour. Not all foundries are affected alike, those chiefly concerned being the producers of castings for export markets and the foundries making castings for household equipment and for the agricultural implement trades.

Supplies of castings to the motor, tractor, and allied trades, whose requirements are chiefly for export, are receiving orders which are much below the quantities previously called for, and many requisitions have either been cancelled or are under suspension, so that levels of production are on a proportionately decreasing scale. On the other hand, the foundries catering for the shipbuilding industry and some of the general engineering and speciality foundries are well employed. The light foundries concerned with the making of castings for domestic equipment are short of work, as are many of the jobbing foundries, which are indirectly affected by the decline in export trade. Many foundries are engaged on castings for the armament programme, and this has enabled them to maintain production.

The supply of pig-iron is about equal to demands, but some grades are none too plentiful. Most of the engineering foundries are able to take up their allocations of the medium- and low-phosphorous irons, and although production of hematite pig-iron has been increased recently, the excessive demands made by the steelmakers leave little extra supplies for the foundries, whose full requirements from some producers are difficult to obtain. Outputs of high-phosphorus pig-iron for the light and jobbing foundries are about sufficient for current needs, but there is little to spare, and the absence of stocks at the furnaces is the cause of many delays in despatch. A furnace, in the Derbyshire area, was recently blown in, and will eventually add about 1,000 tons a week to present outputs, and two more furnaces are due to be put into blast in that area in the near future. Unless trade improves at the foundries which use this grade, outputs may then be greater than demands. With their reduced requirements, the foundries are not calling for the same quantities of refined iron, and some makers have tonnages to spare.

Some re-rollers are very short of steel semis, and those in the Birmingham area appear to be mostly affected. This applies both to re-rollers of small bars and sections and to the sheet re-rollers, and they are again dependent on day-to-day deliveries of material, with the result that it is difficult to fix rolling programmes. Some re-rollers are receiving little supply from oversea and home steelworks, although fulfilling their normal allocations, are unable to send additional supplies. It is hoped that they will be able shortly to spare some extra supplies from the improved outputs now being obtained, particularly in carbon qualities, which are so badly needed.

Orders for the products of the re-rollers are well maintained from home consumers, but export business for light sections and merchant bars is still very scarce, because of the severe competition from abroad.

With only a few working days left before the end of the year makers of finished steel are doing all possible to maintain their outputs at the high level recently achieved, but even so a considerable tonnage is likely to be carried forward into 1953.

Non-ferrous Metals

The Minister of Supply has announced that, as from January 1, the provisions of the Copper, Lead and Zinc Distribution Order, 1951, will cease to apply to zinc. The removal of this control means that licences will no longer be required for the purchase or sale of zinc; it arises from the decision already announced to reopen the London Metal Exchange on January 2. Licences will henceforth only be required for the purchase of copper.

As stated in our last issue, the Government has completed its discussions with the trade on arrangements for the release of zinc from its stocks during the first half of next year. The Ministry of Materials will sell back to the agents of the United Kingdom and other Commonwealth producers 24,000 tons of zinc of their own brands. This metal will be available for immediate delivery during the first half of the year, and it is estimated by the Government that consumers' needs ought to be comfortably covered, for within a matter of perhaps six weeks or so supplies should be moving towards this country from abroad. There will also be our own home production, which is not inconsiderable. It is emphasized that no other zinc from the Ministry's stocks will be released during this period, apart from sales by the Government broker on the London Metal Exchange when no other prompt supplies are available. The 24,000 tons of zinc will be priced on the basis of the monthly average L.M.E. quotations over the six months February to July, 1953, at the rate of 4,000 tons a month. It seems likely that matters will proceed smoothly, if only because the experience gained in lead is going to be of considerable assistance in running the zinc market.

The general expectation is, that not only will the present zinc quotation of £110 not be maintained, but a considerable setback seen when the market opens on January 2. Naturally this is guesswork, but some guide is afforded by the price level on the Continent, which is somewhere in the neighbourhood of £80 for G.O.B. quality. In any case, it is hardly to be expected that zinc will rule above lead, and indeed if the American comparison is anything to go by then there ought to be a difference of about £12, for zinc in the United States is 1½ cents below lead. Doubt also attaches to the premium for high-grade metals, which at present rules at £4. Will this be increased? The answer probably lies with the zinc producers, who may feel that they ought to be paid extra more in line with that ruling in the States. Electrolytic zinc is in considerable demand in this country, and an increase in the premium would not be popular with consumers.

Official tin prices on the London Metal Exchange were as follow:—

Cash—Wednesday, £943 10s. to £944; Thursday, £945 to £946; Friday, £945 to £945 10s.; Monday, £948 to £948 10s.

Three Months—Wednesday, £941 10s. to £942; Thursday, £943 to £943 10s.; Friday, £943 10s. to £944; Monday, £945 to £945 10s.

Official prices for refined pig-lead were:—

December—Wednesday, £96 10s. to £96 15s.; Thursday, £96 10s. to £96 15s.; Friday, £97 15s. to £98; Monday, £98 15s. to £99.

March—Wednesday, £96 10s. to £96 15s.; Thursday, £96 5s. to £96 10s.; Friday, £97 5s. to £97 10s.; Monday, £98 10s. to £98 15s.

Remember the old Proverb!

"Don't spoil the ship for the sake of a coat of paint"—
well, don't spoil a casting for the sake of Chaplets and Studs

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

December 22, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 8s., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £15 19s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 14s. 6d. South Zone, £17 17s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £18 14s. 6d.; South Zone, £18 17s.

Cold Blast.—South Staffs, £18 2s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £16 2s.; Scotland (Scotch iron), £16 8s. 6d.; Sheffield, £17 3s.; Birmingham, £17 9s. 6d.; Wales (Welsh iron), £16 8s. 6d.

Basic Pig-iron.—£13 19s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 22s. to 28s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. to 11s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204 to £210 per ton; 38/40%, £235 to £265 per ton.

Ferro-tungsten.—80/85 per cent., 27s. 6d. to 28s. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 30s. 8d. to 35s. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 7s. 6d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £49 0s. 8d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 to £275 per ton; 96/98%, £280 to £295 per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. to 60s. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £41 12s. 6d.; galvanized corrugated sheets, 24 g., £52 9s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 7s. 9d.; nickel-chrome-molybdenum, £79 2s. 6d.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £948 to £948 10s.; three months, £945 to £945 10s.; settlement, £948.

Zinc.—G.O.B. (foreign) (duty paid), £110; ditto (domestic), £110; "Prime Western," £110; electrolytic, £114; not less than 99.99 per cent., £116.

Lead.—Refined pig-lead: December, £98 15s. to £99; March, £98 10s. to £98 15s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £130 15s.; rolled zinc (boiler plates), all English destinations, £128 15s.; zinc oxide (Red Seal), d/d buyers' premises, £136.

Other Metals.—Aluminium, ingots, £166; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £70 10s. to £71 (nom); nickel, £454.

Brass.—Solid-drawn tubes, 26½d. per lb.; rods, drawn, 37d.; sheets to 10 w.g., 291s. per cwt.; wire, 32½d.; rolled metal, 277s. 9d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 32½d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £195 to £218; BS. 1400—LG3—1 (86/7/5/2), £205 to £238; BS. 1400—G1—1 (88/10/2), £320 to £375; Admiralty GM (88/10/2), virgin quality, £325 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £350 to £385; L.P.Bl, £250 to £275 per ton.

Phosphor Bronze.—Strip, 413s. 3d. per cwt.; sheets to 10 w.g. 435s. per cwt.; wire, 49½d. per lb.; rods, 44½d.; tubes, 42½d.; chill cast bars: solids 4s., cored 4s. 1d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9½d. per lb. (7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3½d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 3½d. to 4s. 4½d.; to 25 in. wide × .056, 3s. 5½d. to 4s. 6½d. Spoon and fork metal, unsheared, 3s. 0½d. to 4s. 1½d. Wire, 10g., in coils, 3s. 9½d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 8½d.; 15%, 4s. 2d.; 18%, 4s. 6½d. All prices are net.

Forthcoming Events

JANUARY 1

Incorporated Plant Engineers

Peterborough branch:—Open discussion on Automobiles (with films), 7.30 p.m., at the Eastern Gas Board's Demonstration Theatre, Church Street.

JANUARY 2

Birmingham branch:—"Metal Spraying for Protection," by W. E. Ballard, and "Reclamation of Worn Parts by Metal Spraying," by R. Wallwork, 7.30 p.m., at the Imperial Hotel.

Institution of Production Engineers

Liverpool graduate section:—"Industrial Administration," 7.30 p.m., at the Exchange Hotel, Tithebarn Street, Liverpool.

Institution of Mechanical Engineers

"Principles and Practice Governing Interchangeability and the Specification of Manufacturing Limits of Size as Influenced by Statistical Considerations," by Captain G. C. Adams, 5.30 p.m., at Storey's Gate, St. James's Park, London, S.W.1.

JANUARY 5.

Institute of British Foundrymen

Sheffield branch:—"Methods of Making a Typical Casting in Iron, Steel and Non-ferrous Metal," 7.30 p.m., at the Sheffield College of Commerce and Technology, Dept. of Engineering, Pond Street.

JANUARY 6

Slough section:—Open discussion, 7.30 p.m., at the Lecture Theatre, High Duty Alloys, Limited, Slough.

Institution of Production Engineers

Nottingham section:—"Economics in Production Engineering," by Dr. F. A. Wells, 7 p.m., at the Victoria Station Hotel, Milton Street.

Incorporated Plant Engineers

London branch:—Discussion on the National Fuel Policy, 7 p.m. (tea at 6.30), at the Royal Society of Arts, John Adam Street, Adelphi, Strand.

South Wales branch:—"A Plant Engineer tours America," by G. E. Halter, 7.15 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff.

JANUARY 7

Institute of British Foundrymen

West Riding of Yorkshire branch:—"Flow of Metal," T.S.35 film and report presented by G. W. Nicholls, 6.30 p.m., at the Technical College, Bradford.

Burnley section:—"Methods employed in the Production of Heavy Castings," by C. F. Lawson, 7.30 p.m., at the Municipal College, Ormerod Road.

Incorporated Plant Engineers

Southampton branch:—"Metallizing in Relation to Plant Maintenance," by J. Porter, 7.30 p.m., at the Polygon Hotel.

Purchasing Officers' Association

Tyneside branch:—"Brains Trust," 7 p.m., at the Crown Hotel, Clayton Street, Newcastle-upon-Tyne.

Wessex branch:—"Care and Maintenance of Rope" (film), 7 p.m., at the Westinghouse Brake & Signal Company, Limited, Chippenham.

JANUARY 8

Institute of British Foundrymen

Lincolnshire branch:—"Flow of Metal," T.S.35 film and report presented by E. M. Currie, 7.15 p.m., at the Technical College, Lincoln.

Institute of Metals

Visit to the Metallurgical Laboratories, Birmingham University, Edgbaston, Birmingham, 15, at 10.30 a.m. "Rolls and their Maintenance in the Non-ferrous Metals Industry," informal discussion at 2.30 p.m. in the University.

Institution of Works Managers

Wembley Sub-branch:—"Space Heating of Buildings and Conditions of Comfort," by Dr. E. H. Mundel, 12.30 p.m., at the Plough, Kenton Road, Kenton.

JANUARY 9

Institution of Production Engineers

Eastern Counties section:—"Motion Study—Practical Applications," by R. Craven, 7.30 p.m., at the Public Library, Ipswich.

West Wales section:—"Electronics in Industry," by A. G. Hickman, 7.30 p.m., at the Central Library, Alexandra Road, Swansea.

Institute of Economic Engineering

London branch:—"Work Study as a Means of Improving Industrial Efficiency," by R. M. Currie, 7 p.m., at Cowdray Hall, Henrietta Place, Cavendish Square, W.1.

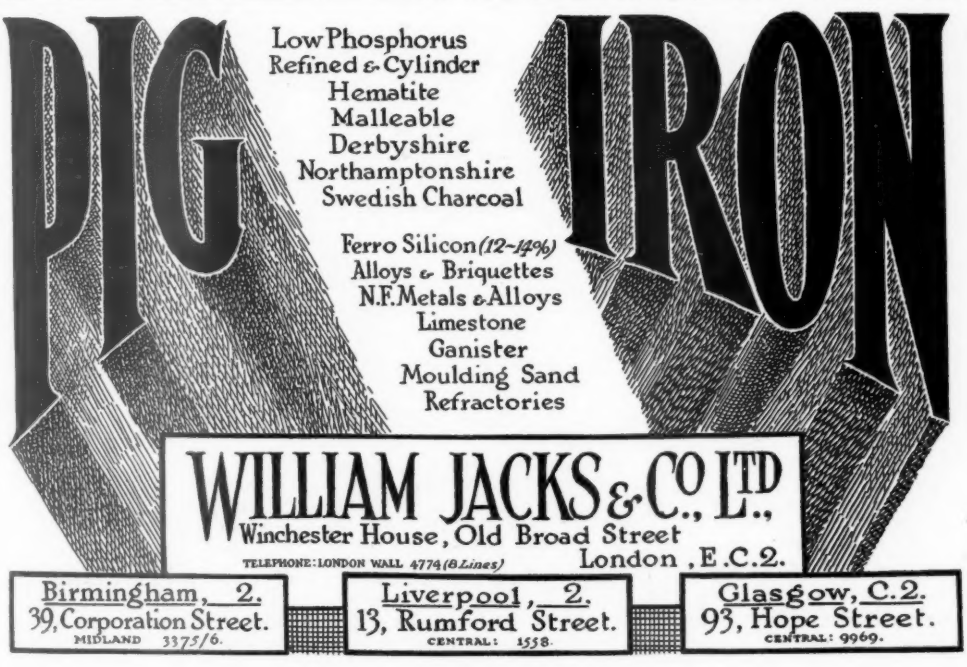
JANUARY 10

Institute of British Foundrymen

Lancashire branch:—"Mechanized Foundry for Small Blackheart Malleable Castings," by J. Roxburgh, 3 p.m., at the Engineers' Club, Albert Square, Manchester.

Newcastle branch:—"Ultrasonic Methods of Inspection," by N. A. Baddeley, 6 p.m., at the Neville Hall, Westgate Road.

Scottish branch:—"Flow of Metal," T.S.35 film and report presented by E. M. Currie, 3 p.m., at the Royal Technical College, George Street, Glasgow.



CLASSIFIED ADVERTISEMENTS

PREPAID RATES : Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952.

METALLURGIST required for Steel Foundry Engineering and Chain Works. Previous Steel Foundry experience essential. Knowledge of alloy steels an advantage.—Apply, stating age and salary required.—Secretary, Brown, Lenox & Co., Ltd., Pontypridd.

FOUNDRY.—Wanted, young man to assist Metallurgist in Heavy Cast Iron Jobbing Foundry, Glasgow area. State age, wage and experience.—Box 3147, Foundry Trade Journal.

EXCEPTIONAL opportunity for keen, conscientious, and fully experienced FOUNDRYMAN to become Partner in private Company of Ironfounders. Full control given on proved results. Minimum capital required £1,000, maximum £5,000. State fullest details of all experience in confidence. This offer is sound; only genuine persons capable of holding responsibility need apply. Attach copies of three references.—Box 3122, Foundry Trade Journal.

SENIOR METALLURGICAL CHEMIST required by Newton, Chambers & Co., Ltd., Thorncliffe, near Sheffield, to take charge of the metallurgical analytical laboratory and to supervise the metallographic section. Applicants should possess a degree in metallurgy or chemistry or equivalent and have experience in analysis of cast iron foundry materials, steels, non-ferrous alloys and industrial liquors and residues, also ferrous metallography. Age, 25 to 35 years. The post is permanent and pensionable. Write stating age and full details of training, experience and present salary to the Personnel Officer, Newton, Chambers & Company Limited, Thorncliffe, near Sheffield.

K. & L. STEELFOUNDERS & ENGINEERS, LTD., Letchworth, Herts., have a vacancy for a young METALLURGIST for technical control and development duties in their Laboratories and Foundry. Applicants should be in the 22/27 age group and of graduate or equivalent educational status. Foundry experience, whilst desirable, is not essential—more important qualifications being personality and a keen interest in steel founding.—Replies, detailing age, education and experience, together with an indication of salary required, should be sent to the Personnel Superintendent at the above address.

AGENCY

MODERN fully mechanised Malleable Foundry in Midlands requires SALES AGENT to cover Lancs and Yorks area. Must have practical Foundry experience and good contacts.—Box 3138, Foundry Trade Journal.

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TWO courses of special evening lectures will be given as detailed below :—

"Liquid Fuels, Their Properties and Utilisation," by G. F. J. Murray, B.Sc., on Tuesday evenings at 7 p.m. commencing on January 6th, 1953.

"Chemical and Metallurgical Thermodynamics," by Dr. O. Kubaschewski, on Wednesday evenings at 7.30 p.m. commencing on January 7th, 1953.

The fee for each course is £1. Enrolment effected by personal application or by post.

MACHINERY WANTED

WANTED — Secondhand polishing machine for cast iron specimens.—Jeffery-Longford Engineering Co., Ltd., Bognor Regis

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FOUNDRY PLANT FOR SALE.

ONE Pneulec Herman rollover and pattern draw machine 60 in. by 86 in., 10,000 lbs. capacity.

One Pneulec Herman jarring machine. Table size 84 in. by 56 in., 7 tons capacity at 80 lbs. sq. inch air pressure.

One Sherwin vibratory knockout 5 ft. 6 in. by 8 ft. 0 in. for operation from 440 volt. 50 cycle supply.

One 7½ ton Clayton monorail hoist with power hoist and traverse.

One 2 ton Clayton monorail hoist with power hoist and traverse.

One heavy duty roller conveyor 7 ft. wide, 60 ft. long with power driven traction chain over 30 ft. length.

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NO. 16 ATRITOR CRUSHER by Alfred Herbert, complete with Feed Hopper, overhauled and with a quantity of spares. Also a No. 12 Atritor by Alfred Herbert, for which we have available about 6 tons of spares. Both these machines are offered at extremely low prices for quick clearance.

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MACHINERY FOR SALE—Contd.

B. T.H. very powerful Dust Extractor-Blower. Motorised unit (unused), £15. One-third to-day's cost.—Bellanger's, 306, Holloway Road, London, N.7. North 4117.

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Pneulec Royer. £85.
Jackman Ballbearing Sand Mill, with a.c. Motor drive. £155.
Sand Mill, by James Evans. 48 in. diam. £55.
New unused Sand Thrower. a.c., 3-phase. £50.
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Foundry Git Cutter, as new, for 1½ square.
Six nearly new Ballard Core Stoves. £55 each.
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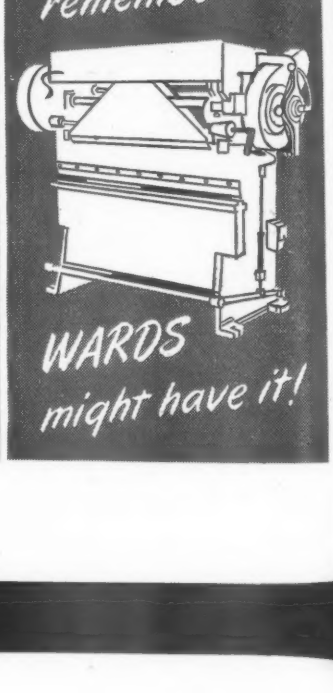
ELECTROGENERATORS LTD., Australia Road, Slough. Telephone: Slough 22577.



FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

The FOUNDRY TRADE JOURNAL is the Official Organ of the following :—

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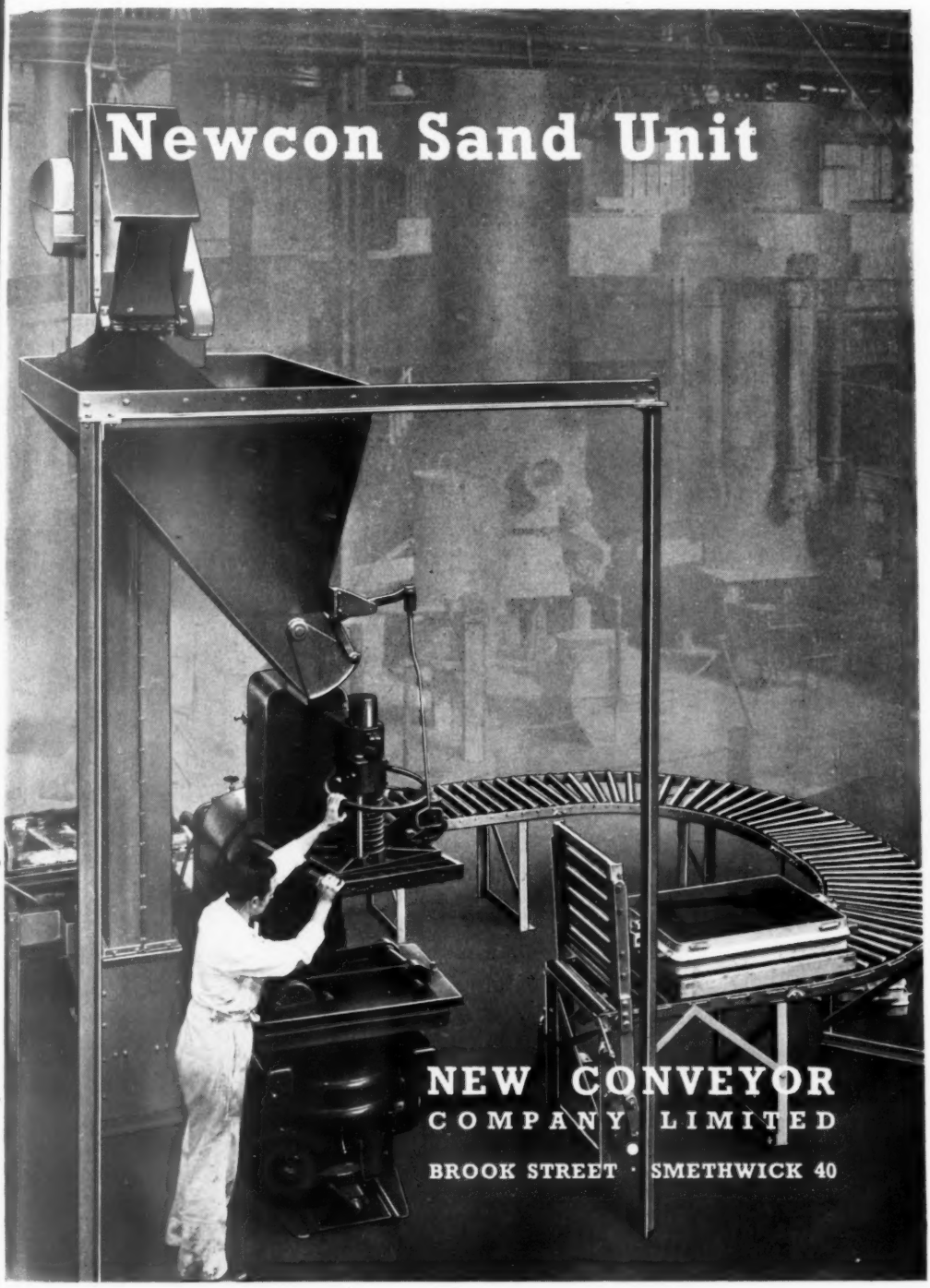
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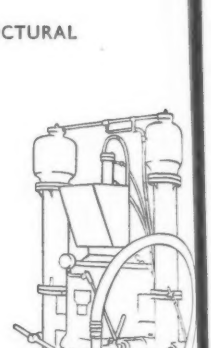

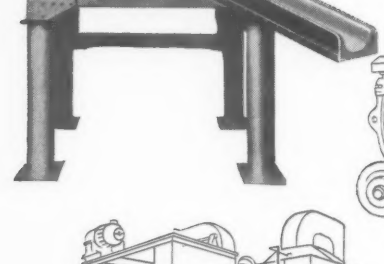

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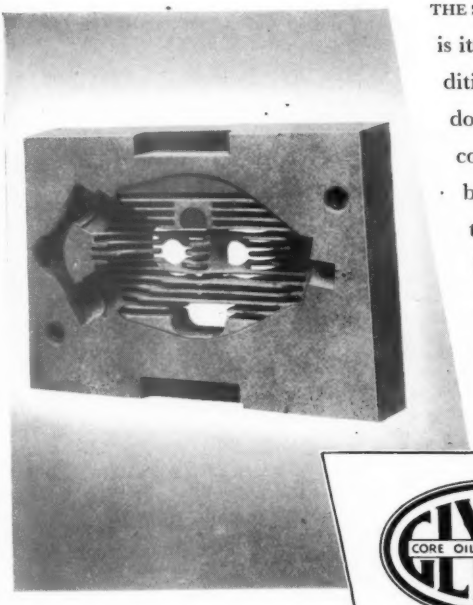

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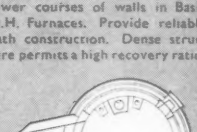

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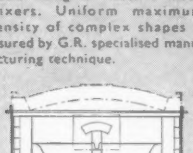

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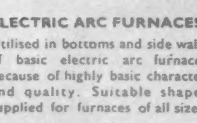

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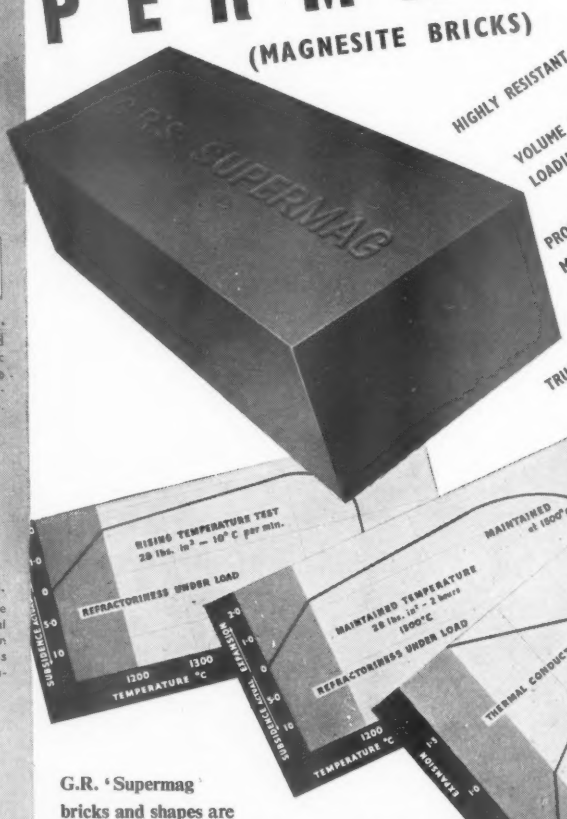

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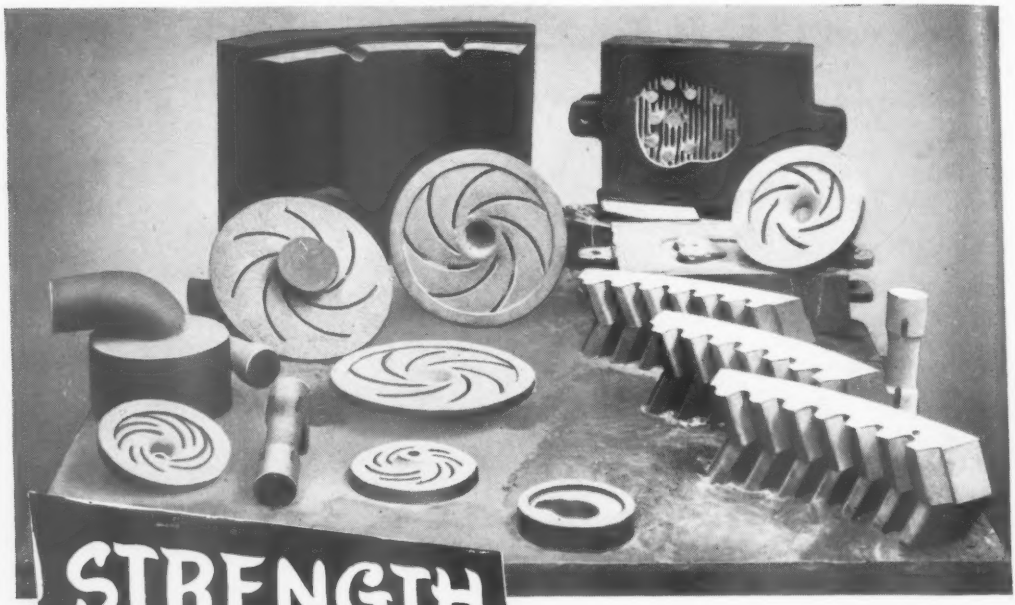

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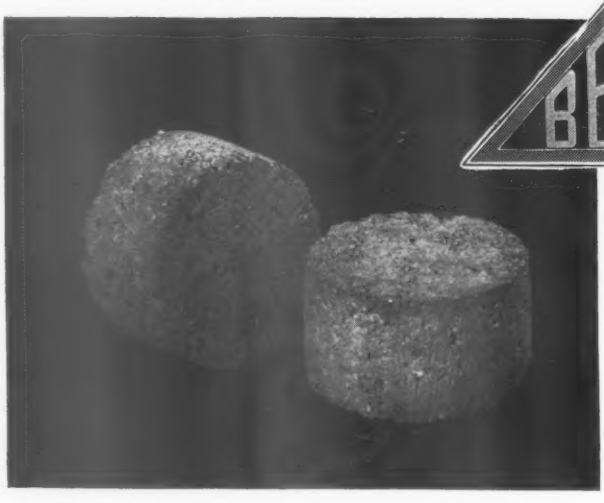

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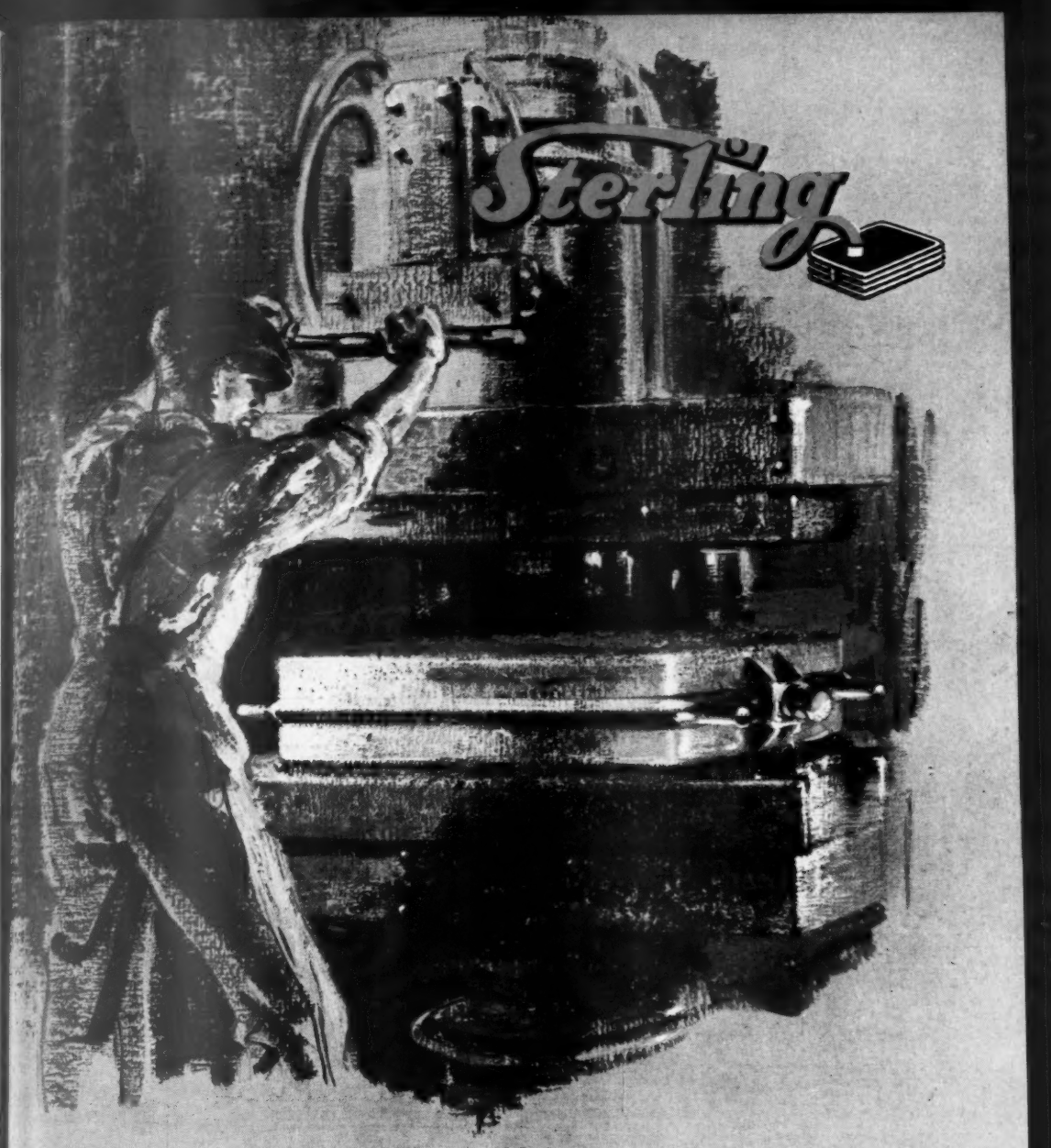

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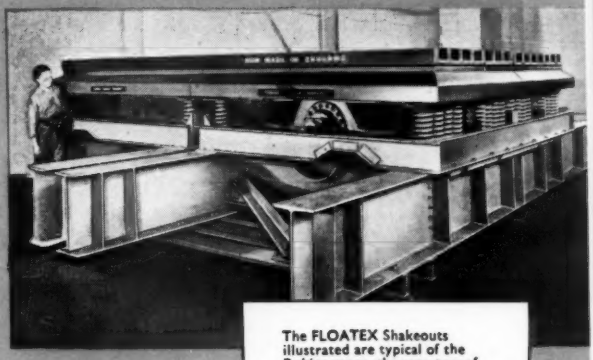

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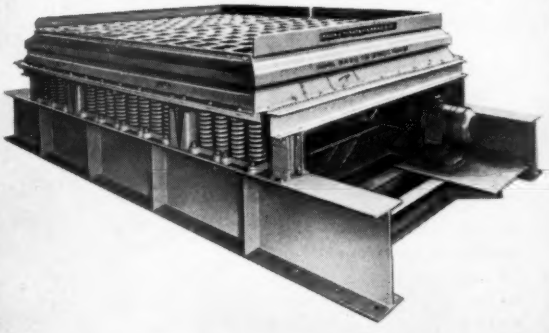

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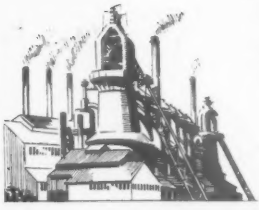

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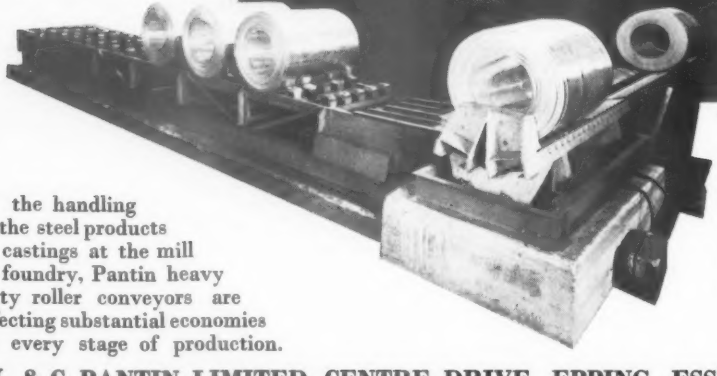

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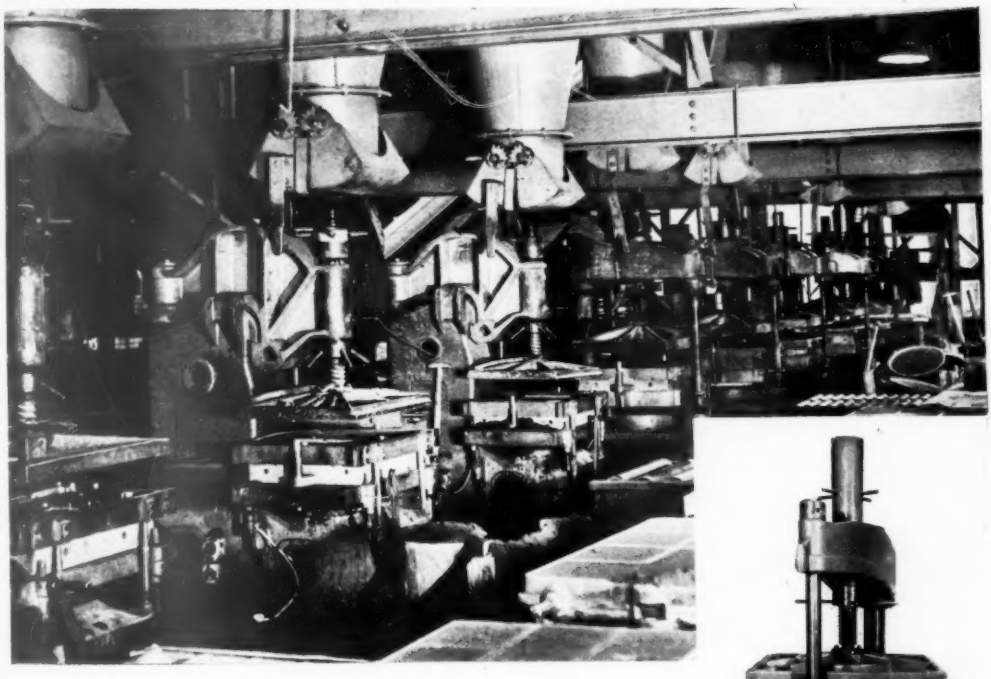

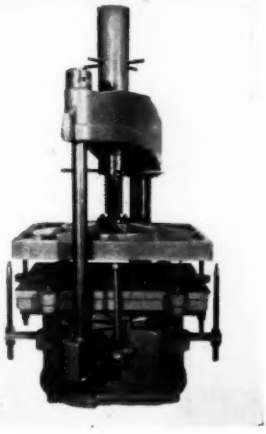

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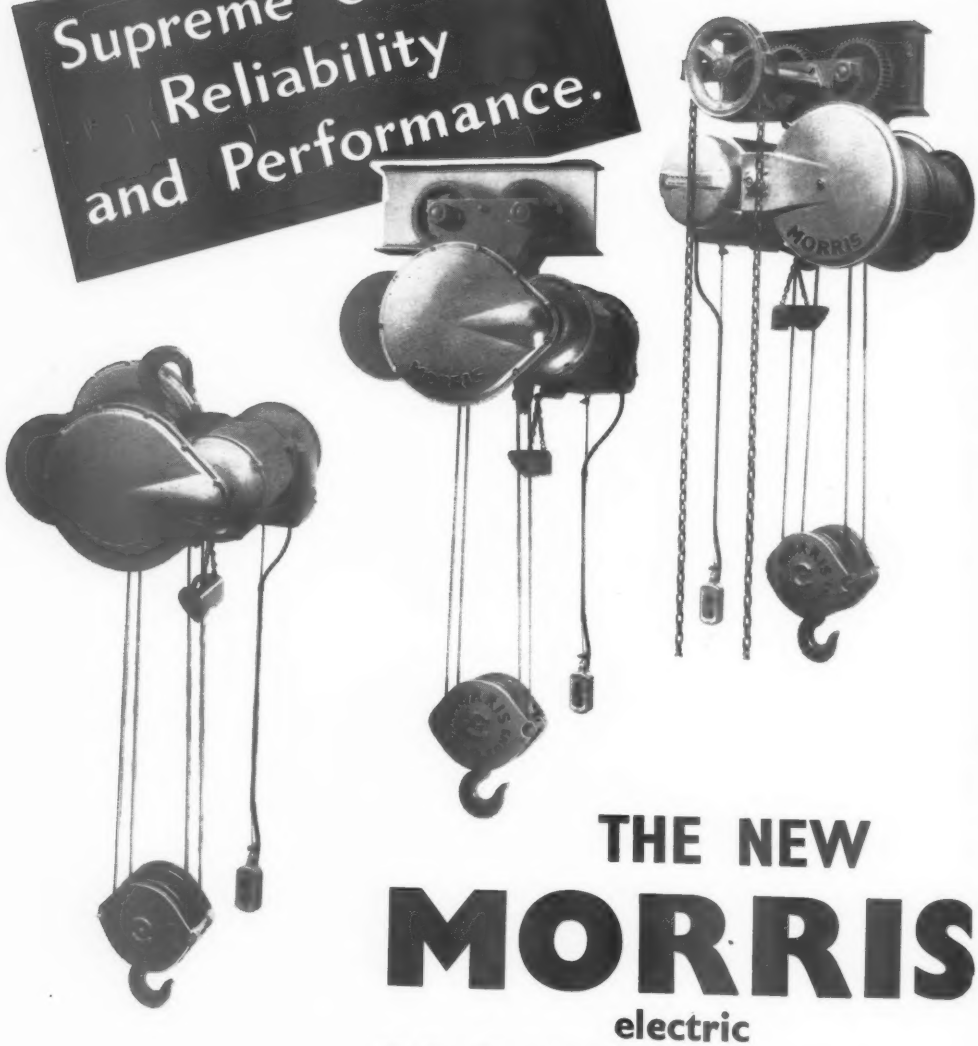

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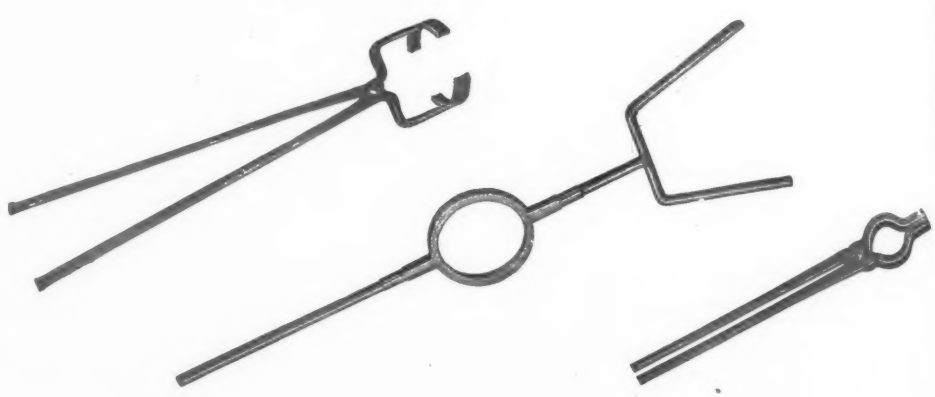

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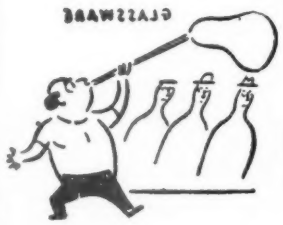

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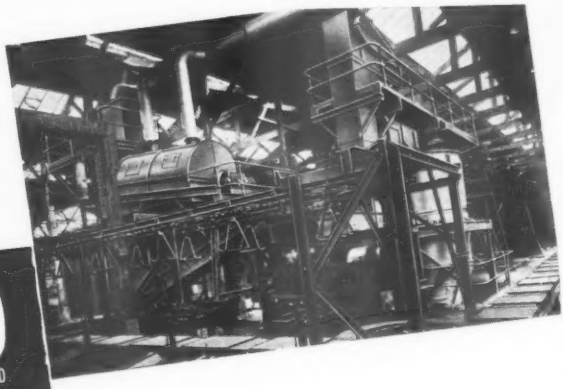

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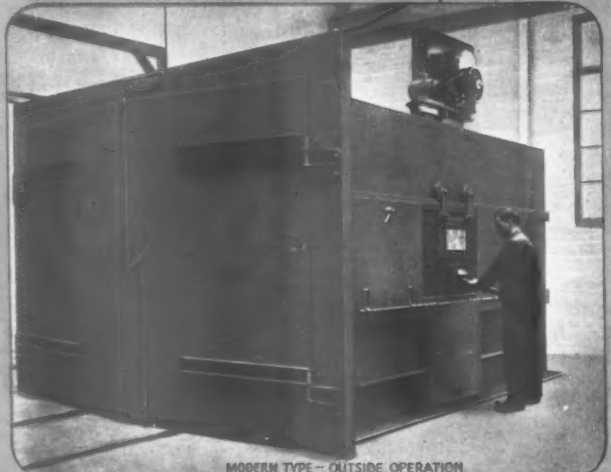

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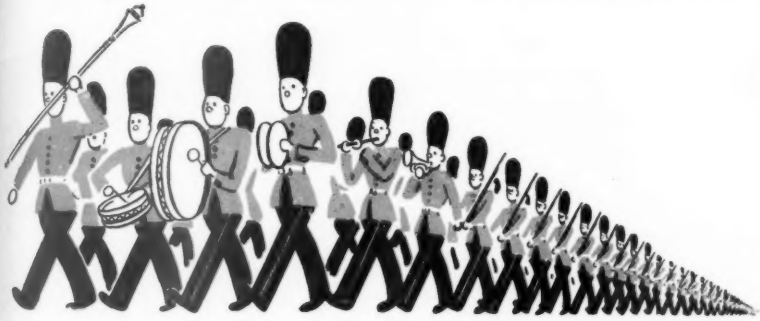

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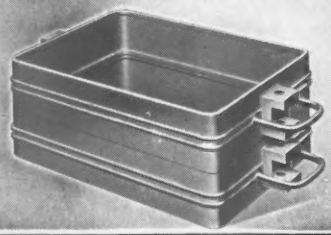

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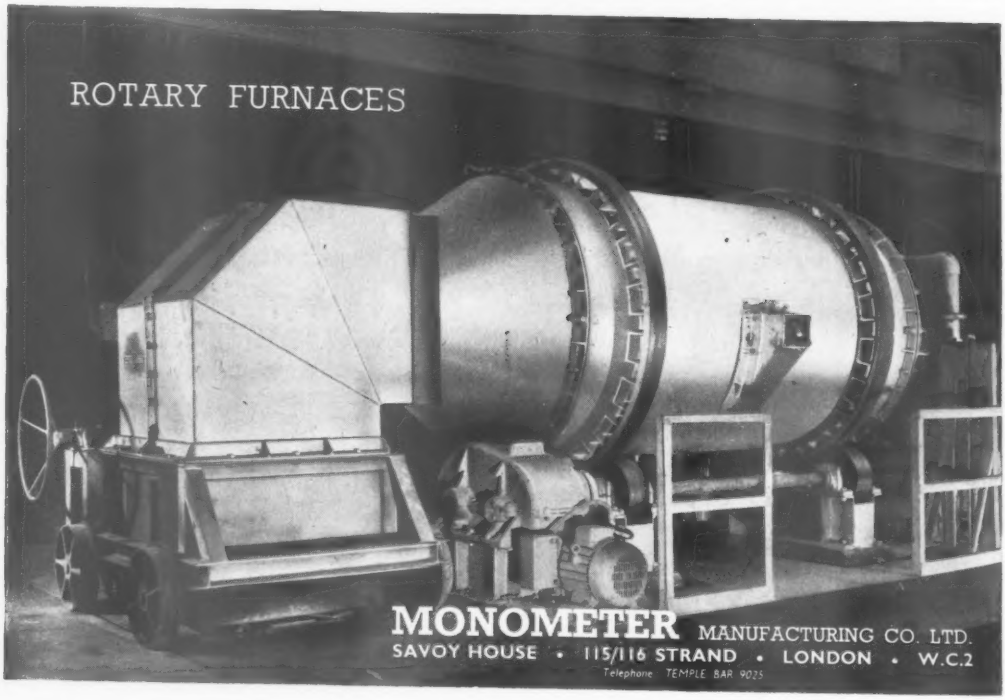

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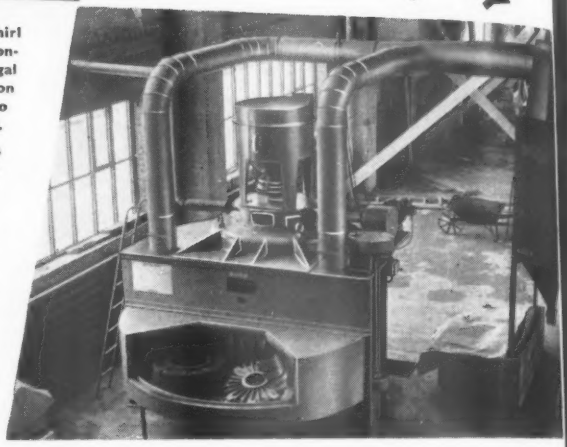

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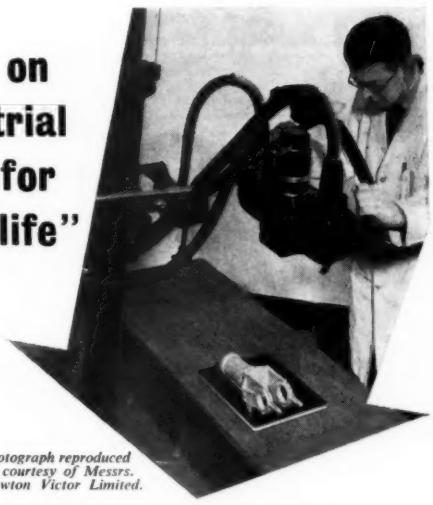

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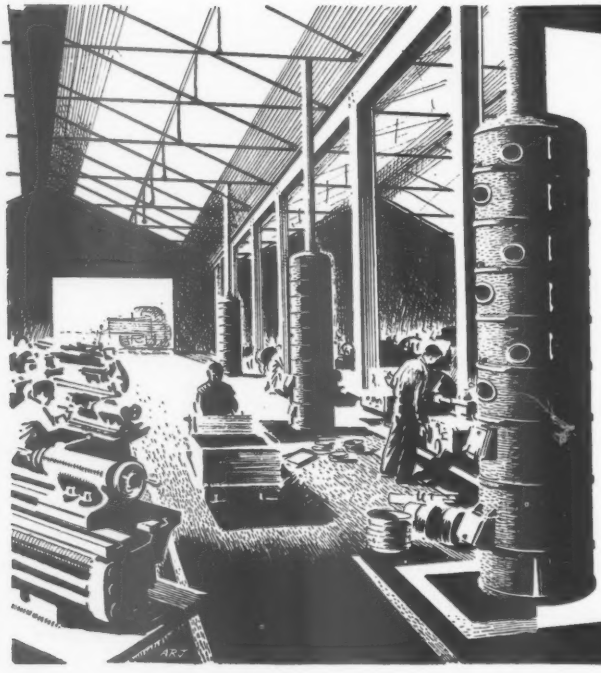

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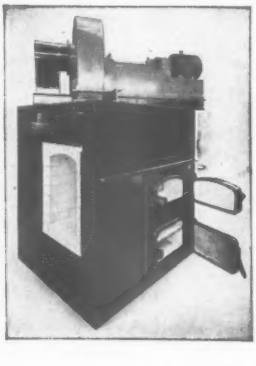

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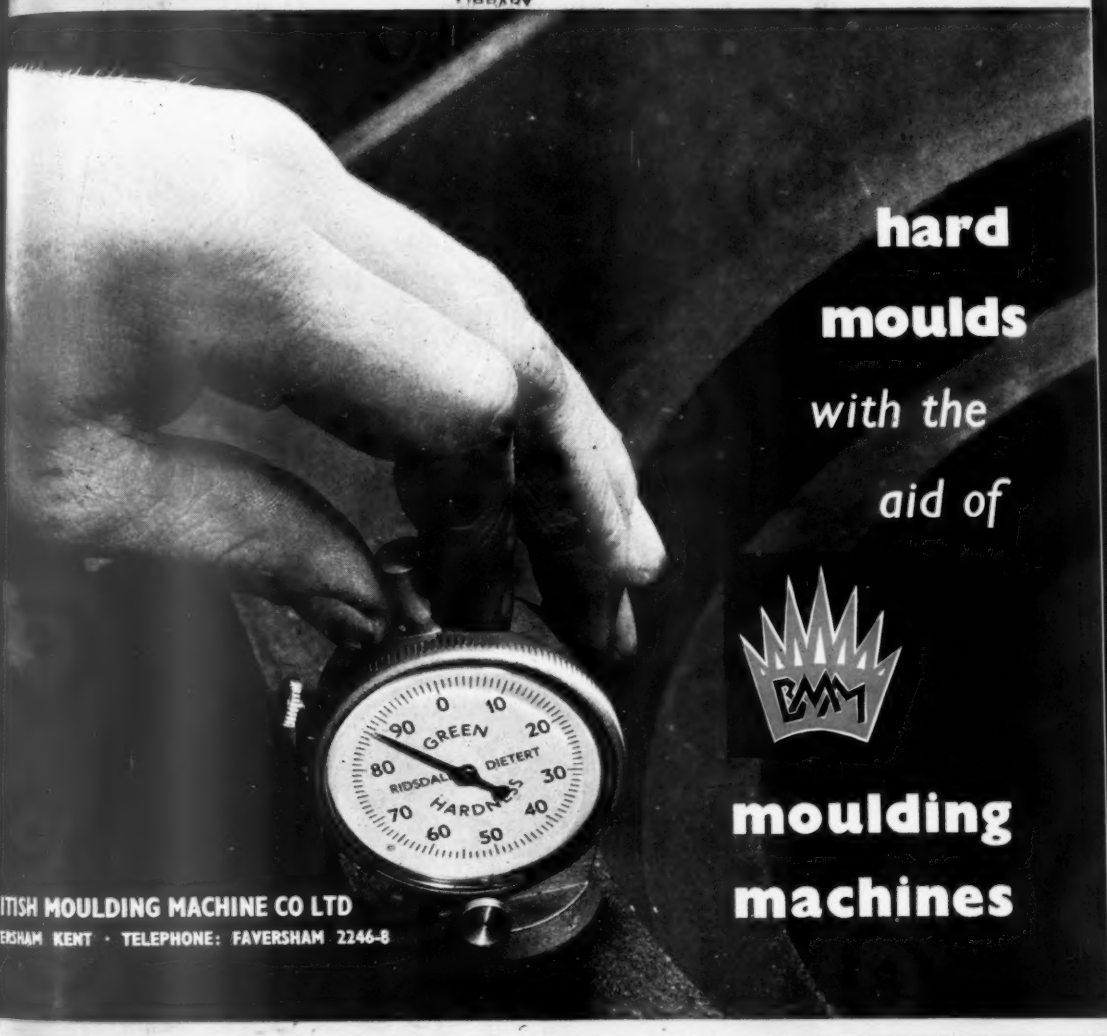

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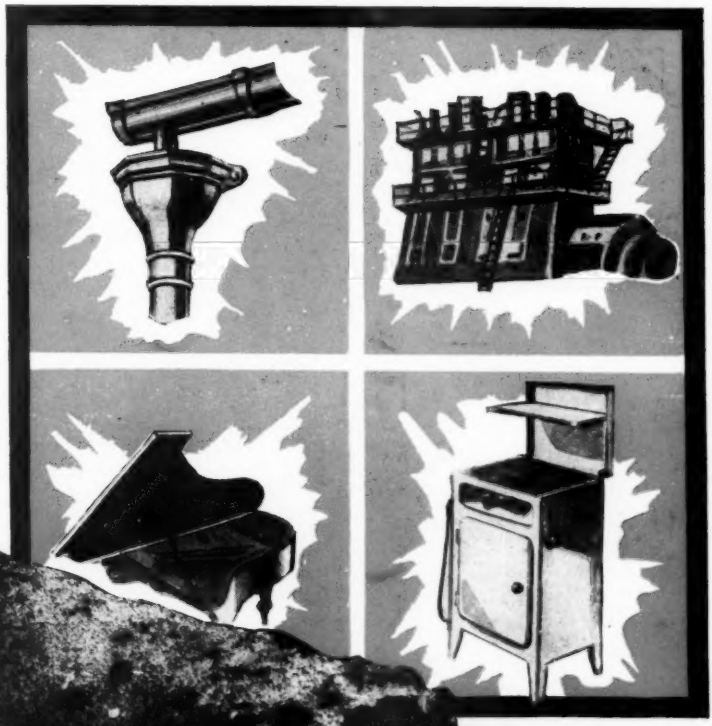

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